Editorial

THE Supreme Court of USA has ruled that there is no bar, legal or otherwise, to the adoption of the CBS color television system in that country.

The ruling was given after RCA had challenged the decision of the FCC to adopt the CBS color system. Broadly speaking, the objection to the CBS system was that it is mechanical and non-compatible with present black-and-white standards, whereas the rejected RCA system is electronic and compatible.

RCA considered the FCC had been hasty in its action, particularly as they claim a big improvement in their electronic color since the first hearing was held, and that it is now equal or superior to that of the CBS.

CBS apparently thinks that now the legalities of the matter have been resolved, the rest will be plain sailing. Reading the comments which have been made in the Press and elsewhere, this may be far from the case.

Experience has shown that no mechanical television systems have succeeded against electronic methods, ever since the day when Baird suffered the disappointment of seeing his disc televisor supplanted by the cathode ray tube for the early BBC programmes.

Most engineers and others experienced in the industry feel in their bones that history will repeat itself. They have a sneaking feeling that the RCA or some similar system is more likely to win in the long run.

RCA have only to plant that idea firmly into the minds of the public and the trade, and it is doubtful whether the CBS system can ever make very much headway. Were television in a semi-saturated condition, and the pubilc looking for improvements, the case might be somewhat different. It is probable that many, when buying new sets, will be happy with black-and-white programmes for some time to come, and that present owners will wait for the day when they can trade in old sets for newer models which don't require messy operations and auxiliary equipment to receive color.

The industry generally, too, may not feel disposed to invest large sums of money in making TV equipment which they feel is only a stop gap.

In other words, although the CBS have been successful with the Supreme Court, it is doubtful whether their victory has much meaning. They have now to convince all and sundry that their system is worth backing with time and money. That may be too hard a job.

John Moyle

INDEX

RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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Vol. 13 No. 6

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Published on the first Friday of each month by Associated Newspapers Ltd., 60-70 Elizabeth St., Sydney.

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OUR COVER PICTURE

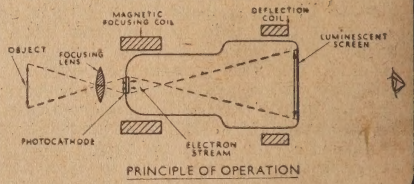
As in other fields, 16mm projectors have reached a perfection scarcely imagined by designers of early models. This streamlined "Ampro" using light alloys and plastics has a total weight of only 33lb.

This is an Image Converter

The action of an Image Converter is achieved by first focusing a projected image on to the photocathode; the resultant stream of electrons is then accelerated, and finally focused on to the luminescent screen. The amplification and precise control of radiations, thus made possible by the Image Converter, opens up important new possibilities to designers of electronic equipments. It can, for example, be used for:—

- ★ Multiple Image Amplification or Reduction.
- ★ Wavelength Conversion i.e. Infra-red or Ultra-Violet to visible.
- ★ Studying Ultra-fast Transient Phenomena of the order of 10^{-7} to 10^{-8} seconds—with time base, the gated tube acts as an ultra high-speed camera shutter.

AN IMAGE CONVERTER IS AN ELECTRON-OPTICAL DEVICE WHICH CONVERTS LIGHT OR NEAR LIGHT RADIATIONS FROM A GIVEN SUBJECT INTO A VISIBLE IMAGE ON A LUMINESCENT SCREEN.



PRINCIPLE OF OPERATION

The Image Converters listed below are the first of a comprehensive range at present being developed by Mullard. For full technical information on these tubes, please write to the Communications and Industrial Valve Department.

TYPE:	ME1200AG	ME1201AG	ME1202CA
Description	Visible image converter	Grid-controlled visible image converter	Infra-red image converter
Focusing and Deflection	Magnetic	Magnetic	Magnetic
Photocathode	Caesium-antimony	Caesium-antimony	Caesium-oxidised silver
Sensitivity (At 2,700°K)	20 μA lumen.	20 μA lumen.	15 μA lumen.
Luminescent screen colour	green	green	rapid decay blue
Max. anode-cathode voltage	6 KV.	6 KV.	5 KV.
Max. grid-cathode voltage	—	6 KV.	—
Max. grid-anode voltage	—	6.1 KV.	—
Linear magnification of image	3 times	3 times	1
Screen resolution	200 lines/cm.	200 lines cm.	200 lines cm.
Typical operation: Va-k	6 KV.	6 KV.	3 KV.
Vg-k	—	3 KV.	—
Vg-k for extinction of image	—	—100 V.	—

Variants of these tubes with different photocathodes and luninescent screens are being developed.

Mullard

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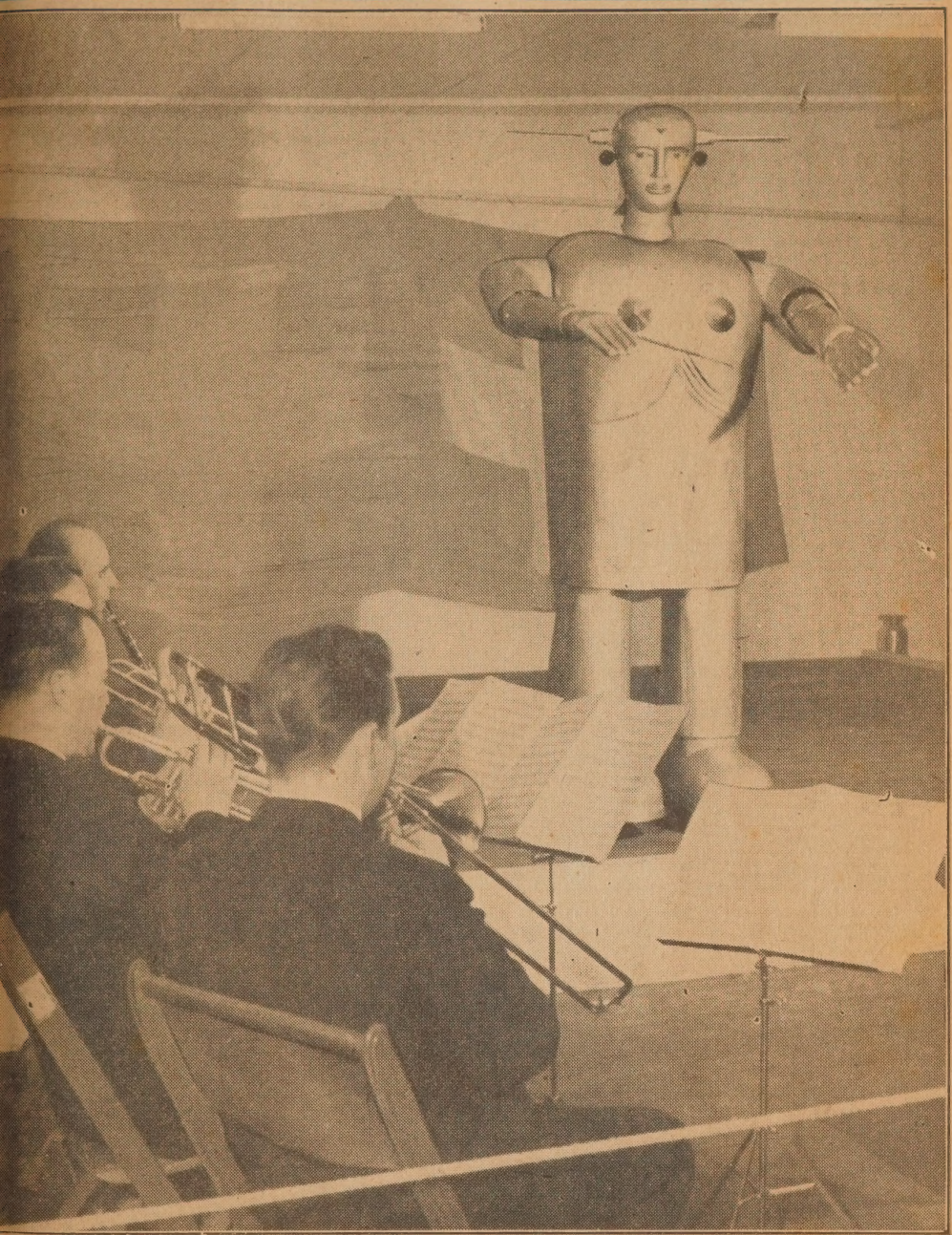
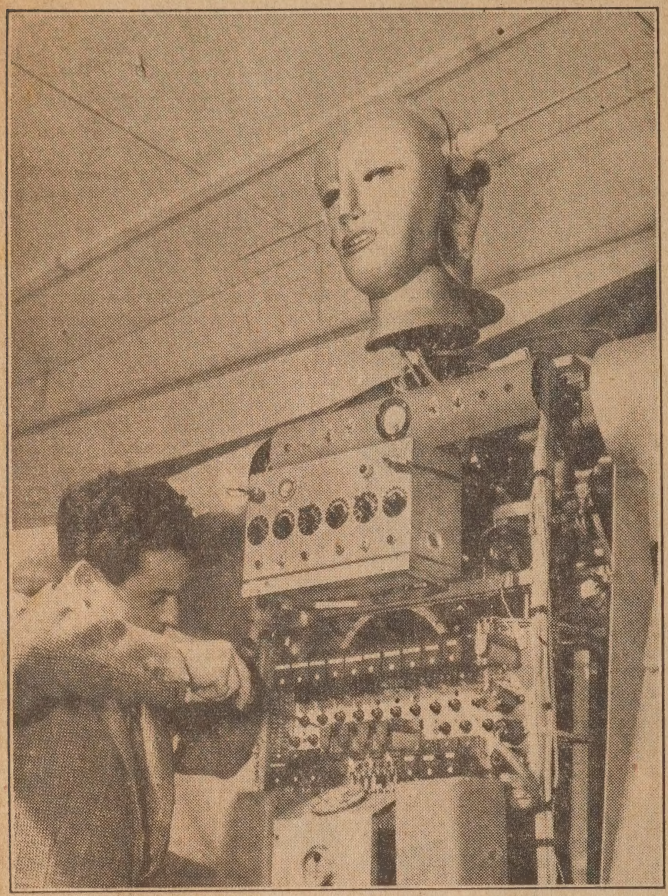
MR6-51

MIGHTY MAESTRO WIELDS BATON



NOT many orchestras have faced a conductor like this one! Just to prove it can be done, an amazing Swiss robot took charge of the Copenhagen Philharmonic Orchestra which it directed without a musical score. The musicians are said to have admired his brilliant musicianship. See story on next page.

SABOR—500 POUND SUPERMAN



Stripped of his metal outer covering, Sabor is an amazing collection of electronic equipment. Valves, switches, relays and motors control his many accomplishments and provide him with a voice.

The idea of mechanical men to work for their masters has been a consistent feature of fiction for many years. Electronics brought the idea into reality, although our robots rarely have the form or semblance of human beings. After all, why should they?

THE modern robot is nearly always found in a form such as an electronic eye which can count operations without fatigue or error, or as a repetition machine performing a complete and ordered chain of operations without supervision and with more than human accuracy.

The mechanical slave, with all the attributes of a human, would be of little value compared with the specialised robots mentioned above. Their perpetuation is mainly in the imaginations of comic strip artists or sensationally popular fiction writers. Only they are able to assume the technical genius and skill required to create and maintain such uncomfortable creations.

Occasionally some enthusiastic and clever person sets out to make a robot in human form, generally for the sheer interest of making a machine behave like a human.

On paper, there is little difficulty in laying out such a robot. Not only could it be made to walk, talk, and perform operations with its hands, but it could be made responsive to the stimulus of light, heat, and sound. It could, for instance, made in one moment to turn head and even walk towards a v which calls it, and in the nex reverse these reactions. Simil it could be made to walk tow light or to avoid light—to appr a green light or stop before a one.

Only mechanical and const tional problems need be solve make such a man, who would only be able to simulate m mechanical powers, but imitate in elementary processes of tho and reason.

So far the most advanced typ robot is probably the electronic c putor, that amazing device w solves intricate mathematical p lems with great speed and accur and in which many of the cha teristics of the human brain created and imitated.

The robot pictured here was signed and built by a Swiss engi Peter Steur, and has been exhib in various parts of the world.

As the photographs show his body, 7½ft high and weighing 5 is packed with a complicated sy of electronic and mechanical eq ment.

These are used to move a legs and head so that the robot walk, smoke cigarettes, turn electric light on and off, and conduct an orchestra.

They are operated from a re control assembly which trans the necessary signals by radio radar. The operator uses a similiar to a telephone selector to set the robot in motion. range of this control is several m

STROLL THROUGH STREETS

It is reported that, on one o sion, the inventor, relying on radio control, sent the robot walk through the streets of Zur

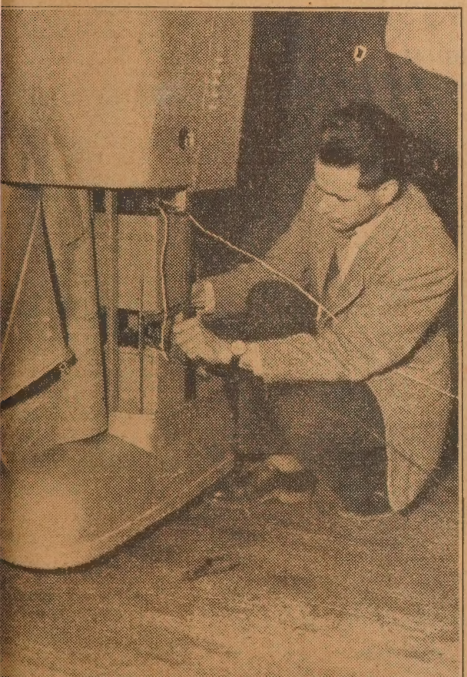
All went well until the r either travelled out of range, developed some internal fault. all events, it came to halt in h traffic and was "booked" for struction!

The robot can be made to about almost anything at all, discourses having previously recorded on wire, and retransm to him. He can carry on con sations, turning his head and in your direction, although in it is the voice of his master would hear. He doesn't act walk like a man but runs on wh under his boots. The problem balancing a 500lb "man" over even grounds would almost certa lead to disaster.

Power for his machinery is t from batteries installed in his It is not stated how long he operate on one charge!

Unfortunately, having built marvel Peter Steur doesn't know he can use it! So he is takin on a world tour in order to re his £50,000 or more of expense ten years of work, to say not of his 50,000 components. In spare time, Sabor acts as a cigare lighter and door-opener!

bor is remote controlled by his inventor who uses an automatic dial connected to a small radio transmitter. Note the wire sound system at left.

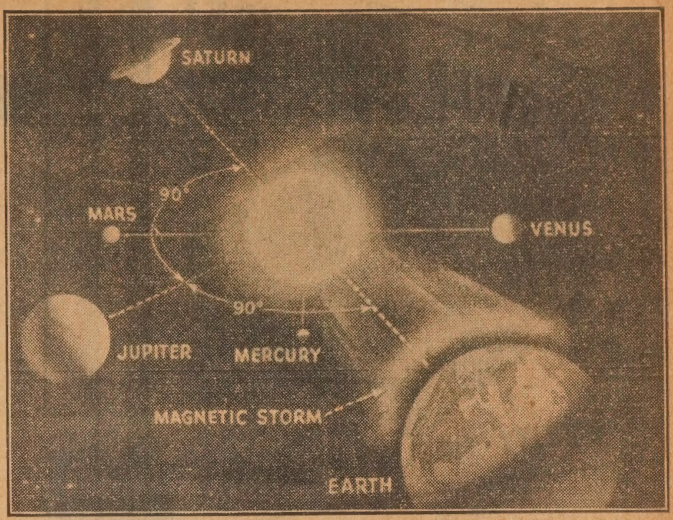


wer for the mighty robot is taken from accumulators which are housed in his legs. Here they are being recharged.

Sabor is a source of wonder to children. This fine picture is a study in juvenile reactions.

PLANETS AFFECT MAGNETIC STORMS

Evidence that a direct relationship exists between magnetic storms on earth and the position of the planets with respect to each other and the sun was disclosed recently by John H. Nelson, radio-wave analyst of RCA Communications, Inc. This information should be of great value in future communication forecasts.



When planets in their travels around the sun arrive in the relative positions shown here magnetic storms appear on the earth.

ERETOFORE, sunspots and allied activity on the solar surface ve been considered prime causes magnetic storms that bombard e earth.

The report suggested that these ruptive forces may be forecast nths or even years ahead of their terialisation, thus permitting ple time to select the best radio annels to avoid curtailment of ffic.

Based on these predictions for the 51-52 winter season, selection al-ady has been made for the best rking radio routes and frequencies its world-wide radio-telegraph cuits to be used under the radio ather conditions forecast for that riod.

BSERVATION OF SUNSPOTS

The conclusions reached were the sult of nearly five years of study-g radio-wave behavior in relation sunspots and the movement of e planets. Using a 6in telescope p a building in the heart of New rk's financial district, daily plots re made of the position and aracteristics of sunspots on the ar surface.

It was during the observation of nspots that Mr. Nelson became nvinced that, besides their activity, er forces acting upon the sun also ected magnetic weather conditions on the earth's surface. This con-tion led him into research in-lving the exact position of planets ith respect to the sun.

By plotting the course of the six inner planets of the solar system on a daily basis, it was found that:

1. When two or more planets are at right angles to each other or in line on the same side of the sun—or in line with the sun between them—magnetic disturbances occur more frequently on the earth's surface.

2. That the most disturbed 12-month periods will be those preceding and following the positioning of Saturn and Jupiter in such a configuration with relation to the sun.

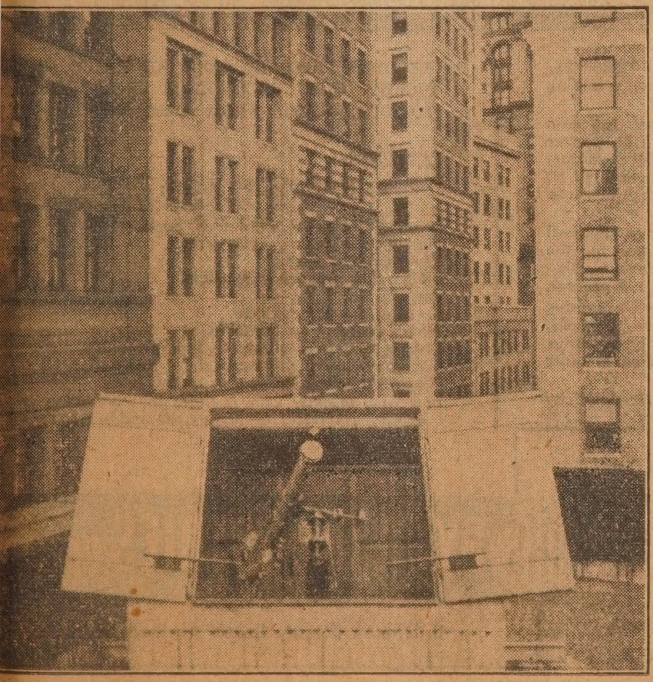
3. That the most severe disturbances occur when Mars, Venus, Mercury and the Earth are in critical relationship near points of the Saturn-Jupiter configuration.

TWO-YEAR PREDICTION

4. When Saturn and Jupiter have moved away from their critical relationship, there is a corresponding decline in the severity of magnetic weather, although storms of shorter duration result from the critical combinations of smaller planets.

5. That the least disturbed periods occur when Saturn, Jupiter and Mars are equally spaced by 120 degrees.

By means of his planetary research, Mr. Nelson has been able to predict for two years in advance



John Nelson trains his telescope on the sun from his rooftop observatory where he discovered evidence of a new relationship between the positions of the planets and magnetic storms.

approach of major magnetic dis-
ances on the earth's surface.
ibining his planetary observations
n a daily telescopic inspection of
sun's surface, he has obtained
accuracy of 85 pc in his daily
casts of good and bad radio
ther.

onclusions presented by Mr. Nel-
lend support to other investi-
rs, notably Ellsworth Hunting-
and Henry Helm Clayton, who
pected that the planets had an
uence upon sunspot activity and
ducted extensive research on the
ject.

NETS AFFECT SOLAR SURFACE

lthough research was related to
earth's magnetic storms in re-
on to radio communications rather
n sunspots, this study indicates
t the planets influence the sur-
e of the sun and the solar react-
frequently associated with sun-
ts.

n developing evidence of planet-
influence, Mr. Nelson prepared
dreds of charts of planet posi-
is, radiotelegraph circuit behav-
and sunspots, and then compared
relationships between them. He
nd that because of their slow
ion around the sun, Saturn and
iter may stay in a critical relat-
to each other for as much as
years in which event the inner
nets, as they circle the sun more
idly, have an opportunity to
ate relationships, which add to the
cts of the Saturn-Jupiter team.
n preparing his evidence, Mr. Nel-
relied heavily on the hundreds of
y propagation reports gathered
him by RCA technicians at River-
d, L. I., and by overseas techni-
ns associated with Radio France
the Telegraph Administration in
eden. Assistance also was render-
by his brother Carl W. Nelson, an
ateur astronomer and meteor-
gist in Massachusetts, who aided
plotting the planetary configur-
ons and in ascertaining the angles
least disturbance.

NSPOT SIZE NOT CRITICAL

Prior to planetary studies that have
de possible his long-range pre-
tions, Mr. Nelson achieved con-
erable success in forecasts based
ly upon his observations of sun-
ts. In 1948, he and his associates
sed comment in astronomical
cles by a report in which they said
ir investigations showed the size
sunspots to be "a meaningless
erion" in predicting disruption
sed to radio circuits. The type of
sunspots, their age and activity,
their position on the face of the
, were declared to be the deter-
ing factors of disruptive bom-
dment.

Moreover, Mr. Nelson and his
ociates established at that time
existence of a "critical zone"
the face of the sun—an area
ut 26 deg. in radius from the
ical centre of the sun, on its east-
hemisphere. It was discovered
t the position of the sunspots in
ation to this critical zone was of
ost importance. Damaging effects
re noted when new active spots
e within this zone.

ubsequent investigations by Mr.
son have shown this critical zone
be expanding as the sunspot cycle
roaches its next low point of
vity, which is expected to occur at
roximately the end of 1954. This
e remains a valuable asset to
Nelson in making his daily fore-
ts of magnetic weather.

POSITION OF HIGHEST ACTIVITY

When the planets and the sun are in the positions shown in this diagram, the resulting bombardment of the earth by magnetic storms reaches its maximum intensity.

STRANGE STAR IS THREE-IN-ONE

According to Dr. Otto Struve of the University of California, one of the strangest stars in the universe is a member of the stellar team making up Capella, the second brightest star in the northern sky.

STREAMS of whirling gas within the atmosphere of this giant sun race around as fast as in any star yet observed, Dr. Struve estimates.

"This star does not resemble any known single star. It may be subject to large changes of a kind we have not found elsewhere in the universe," Dr. Struve pointed out.

Capella is visible during spring evenings in the northwest, in the constellation of Auriga, the charioteer. It has been known for several decades that Capella is composed of two giant stars, of about equal brightness. These twin stars are so close together observers always see them as one, but astronomers using Mt. Wilson's 100in telescope have actually seen them both. There is a third distant companion, a red dwarf.

The two giant stars circle around each other every 104 days. One of these giants is similar to our sun, but ten times as large; the other is somewhat like Procyon, bright star in Canis Minor, the smaller dog.

Astronomers have failed to realise, however, in how many ways this star differs from Procyon and other stars of the type it most nearly resembles. Capella has played an exceptionally important part in the development of theoretical astrophysics, a role it probably would not have been given had its peculiarities been fully appreciated.

Several decades ago the late Sir Arthur Eddington, famous British astronomer, used Capella as one of the two anchors to which he attached his famous mass-luminosity relation, the other anchor being the sun. This star was fundamental to his theory that massive stars of necessity shine brightly.

It was Capella, along with other stars, that led Sir Arthur to conclude that a body of gas having less than a tenth of the sun's mass would be unable to shine by its own light, whereas one of a thousand times the sun's mass would be subject to so great internal pressure of radiation that it would probably burst.

The star's spectrum—its light fanned out to its rainbow colors—is like a coded message requiring not one but two keys for its decoding. It is easy to match lines in Capella's spectrum with those of a star like the sun or Arcturus, in Bootes, the herdsman, high in the northern sky.

The spectrum of the other star making up bright Capella is unlike that of any other star Dr. Struve has encountered. Its strong spectrum lines are enormously enhanced and broadened, and its weaker lines are completely blocked out, he says.

IS IT FACT OR IS IT FICTION?

I think—and I am told to say what I like—that skill in observation covers all happiness, education and knowledge. I will be blunt and say that, in my opinion, most people walk through life—or run nowadays—with their noses to the ground like cabbages. Cabbages do have noses in the sense that they are very responsive to gaseous atmosphere.

by Professor A. M. Low

DAY (I will get to the point in a moment) education has reached tage where we often read pages mathematics written for the one pose of giving complication to few simple things we know.

he "facts" of which we can be ain are so few that we are still e better than savages. We re very strong links with our dim

you doubt this statement, note a large number of children are with such noticeable tails as require surgical treatment; while , and myself also no doubt, have ats which correspond with pain- accuracy to those of our ances- , the fish.

MORISING "FACTS"

am quite sure that the drawing ndless curves and the memorising nlimited data, called "facts" only use they have not yet been ved to be untrue, can in no way ace observation. That is what I k.

ake "jets" as an example. I read they are new and that they are . That they were invented in land, and that they were invented taly. None of this is true.

or millions of years fish have d the reaction principle in a most ful manner, and in many tropical s these creatures can be seen mming backwards and forwards means of water sucked in or en out.

undreds of years ago, when I a boy, we used to make power- ts on a very similar principle by ng a metal U-tube in a piece vood and heating the curved part a spirit lamp.

hese little models were jet boats. hot water was blown out, and steam condensed by the surround- cold water which thereupon ed in to be blown out again, so the boat quivered to the touch t dashed quickly around the local d.

RS AGAIN

he remarkable part of all internal bustion engines of every kind is most of them are totally un- ed to their job. The motor car nly satisfactory because its fuel lean and well distributed. In it is crazy.

e want to get as much cold mix- into an engine and turn it as dly as possible into gas, because only criterion of efficiency is the ght of mixture in and out of cylinder per minute.

hat is one kind of efficiency. To re all the others, such as com- silence and convenience, we not turn the petrol into a gas the combustion chamber over- s. We want to compress it and e it burn quickly and efficiently, but we must let it combust very slowly if the whole of the power is not to be wasted in gears.

We would also like the heat to be turned into mechanical work, so, logically, the cylinder should be exceedingly hot. Do this, and the incoming gases are overheated.

The solution is gloriously simple. We buy an expensive radiator, and deliberately waste 30 pc of the heat. We fit a costly exhaust system to make sure of getting rid of another 40 pc. Frightfully scientific, is it not?

The flying bomb was a clever device because of its control, its turbine-fed mixture regulation, its gyroscopes and its direction indicator. But its engine, using a poor compression ratio and allowing the gas of combustion to drive into the atmosphere, so that equal and opposite reaction to this putting off of weight drives the machine forward, was by no means marvellous.

INEFFICIENT MOTOR

Fuel consumption was appalling. What is exciting is the rocket and, in this case, the reason is not only that of its skilful control.

It is because for the first time a fuel is being used which is complete in itself, carrying its own oxygen for combustion. Allowing for the need for the machine to travel, when there is no atmosphere before it can move efficiently, it suggests the possibility of all kinds of queer progress.

You may say that rocket posts, high-speed overseas travel and control by radio are more or less obvious, but what appeals to me is that peak horsepower may be in the neighborhood of 500,000 or more.

When I am told sarcastically that this only lasts for a minute or so, I point out that, if you could reduce the horsepower to 20, the time would proportionately increase, and I see no reason why something of this kind should not eventually be accomplished.

Anyone who troubles to think must agree that the modern reciprocating engine is chiefly interesting for its triumph over difficulties. Thermally, it is horrible; mechanically it is worse still. Who in their right minds would want to take a few dozen relatively heavy pistons and throw them backward and forward many times a second?

The engine is expected to do this, and more, and is further asked to function reliably with a temperature in its stomach very nearly high enough to liquefy steel.

It looks to me as if reaction machines, if you will forgive my colloquialism, are one day destined to make speeds of a few thousand miles per hour quite common.

It may happen that in the far future old ladies will mistake Africa for England instead of Golders Green for Hampstead Heath. And we shall know that men wearing white ducks and solar topees are not mad because they cross Hyde Park on Christmas Day.

They are, of course, spending Sunday afternoon in Africa.

No! I am right. Popeye had the idea of reaction and relativity most accurately. You may remember that after a helping of spinach he would commonly pick up an aeroplane by what vulgar people call the "prop" and spin the whole kite around it instead of the other way about.

It should indeed be a source of satisfaction to know, when we start a car and let in the clutch, that it is the engine which revolves and not the car. Relatively speaking, there is very little difference.

AIRSCREW FLUTTER

Nor is this point so foolish. One of the great causes of airscrew inefficiency used to be that of flutter. The engine fires, we hope and, at each kick, the tips of the blades are left behind.

As these blades are springy, a high-speed cinematograph may show that the end is vibrating like a comic picture of a dog's tail, and some wonderful statistics were once compiled to show that 15 pc of total horsepower could be lost in this fashion.

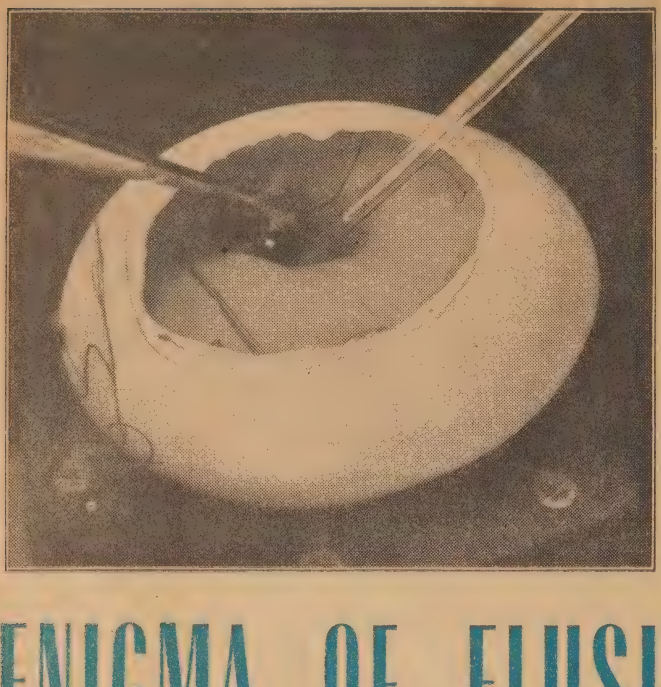
I should hate you to say that these are very small things and therefore, of no interest. Just the other way about. Before long our world will be moved, controlled and organised by the everlasting dance of atoms with their electronic chorus.

I once took the trouble to work out the amount by which the middle span of Sydney Harbor bridge bent when a butterfly landed upon it. Quite a simple calculation but enough I think, to remind us that very few things which we ordinarily see are so interesting as the very small.

Half the marvels of life must have been totally untrue to those who had only their unaided eyes, and much more than half modern science is devoted to the discovery of instruments by which our senses can be apparently improved.

It will have occurred to you that the cinematograph and television

(Continued on Page 33)



Only the electron microscope is powerful enough to "see" the virus. Those to be studied are drawn off from a living egg in this picture before being magnified up to 150,000 times.

ENIGMA OF ELUSIVE VIRUS

One of the key problems in man's fight against disease is the virus, that great dealer of death whose toll weighs heavily on the human race. The virus is responsible for poliomyelitis, smallpox, mumps, measles, virus pneumonia, common cold, yellow fever, scarlet fever and many other diseases.

by Calvin Walters

IN the animal world the virus causes cattle plague, foot and mouth disease, rabies (hydrophobia), fowl pox, swamp fever of horses, and certain malignant growths and tumors.

In plants the virus is the cause of tobacco mosaic disease, curly-top of sugar beet, tomato spotted wilt, potato yellow dwarf, lucerne mosaic, aster yellows and a variety of other complaints.

It is thus seen that the virus has a wide and deadly distribution which puts it in the forefront as a deserving subject for intensive research.

The virus has been known since 1892, when Iwanowski found that the active principle which caused the disease known as tobacco mosaic would pass through the pores of the finest filter then known.

FILTERS USELESS

At that time all organisms known to the scientific world would be stopped by such fine filters.

Of course, the agent responsible was not identified and was not even then known as a virus. No further research was conducted till many years later.

Tobacco mosaic disease is one which is dreaded by tobacco-growers throughout the world. It causes the leaves of the plant to pucker up and have a mottled appearance like a mosaic.

This virus is one which is considered as being representative of all viruses and, fortunately, has properties which make it easy to carry out research upon.

CANNOT BE SEEN

A lot is known about ordinary disease-producing germs. Firstly, they are of comparatively large size, they can be cultivated on artificial media and are visible under the ordinary microscope. They are living organisms and require food for their propagation.

The virus, on the contrary, are so small as to be invisible under the microscope. They cannot be cultivated artificially. They multiply only within the living cell and they have the ability to change or mutate during the process of multiplication. The virus is not known to be a living organism.

Well, then, say you all, "If the virus cannot be seen, if it can't be cultivated artificially, and if it is not known as a living organism, for the heck do we know whether there is such a thing at all?"

TOBACCO VIRUS

Well, then, you will be amazed at the answer. SOMETHING can be seen after repeated purification of juice from an infected subject. SOMETHING is left behind after evaporation which is capable of transmitting the characteristic disease, and this something is nothing like a living organism as we know it. It is a chemical crystal. But we are getting ahead of our story.

A certain Dr. Stanley, of the Rockefeller Institute of Medical Research in New York, took up the study of viruses from an entirely new angle. He used all branches of science in order to track the virus to its lair.

The virus of the tobacco mosaic disease was the one chosen for his experiments.

Dr. Stanley took tobacco plants suffering from the disease and ground them into a pulp. In this way he got gallons of juice which contained the virus. He knew it was there, for when any of the juice was touched upon a healthy plant, that plant contracted the disease within a very short time.

The problem then became one of getting the virus qut of the juice. Now, plant protoplasm consists of carbohydrates, fatty compounds, hydrocarbons, metal salts and proteins. Dr. Stanley's reasoning led him to believe that the virus may reside in any one of these.

Now, protein is a most complex substance, but can be split up into a substance called Pepsin. In other words, it can be digested just as

animal stomach by the pepsin ein.

ome of the infective juice was ficially digested with pepsin in a tube and then applied to a lthy plant. Nothing happened. It med that the virus was rendered ocuous by being digested with sin.

n view of the fact that pepsin has effect on the other components protoplasm, it was reasonable to pose that the virus was contained the protein or that it was even tein itself.

PARATING PROTEIN

t is possible to precipitate proteins h certain chemicals, and this Dr. nley set about to do. He added micals to the raw juice and a iment or precipitate of protein tter was thrown out. It was found t the juice which remained had infective properties but that the tein sediment was just as infec- e as before. It was therefore plain t the infective virus was con- ned within the protein.

Here chemistry came into full play. certain compound of ammonia ich throws protein from a solution thout change was used, and a nch of crystals began to form in bottom of the test tube.

These were dissolved in a neutral uid and crystallised once more th the ammonium compound. This ocess was carried through ten suc- ssive stages each stage using a eater dilution with the neutral id.

It was assumed that, at this point, foreign matter was contained in e crystals. Furthermore, no living ganism was known which could be crystallised and remain unchanged alive.

Dr. Stanley diluted some of the ystals with over 100-million times eir bulk of neutral sterile liquid d applied a drop of the solution the leaves of a tobacco plant. arvels of marvels the plant showed l the signs of having contracted the sease.

What else could be thought but at here in these crystals—yes— ven the crystals themselves were the tual virus. The laws of chemistry

This centrifuge separates the virus from other matter.

ruled that the crystals were an absolutely uncontaminated single substance.

These crystals can be seen through the microscope and appear as white needles. As each crystal consists of molecules, millions of them, it is considered that each molecule of each crystal is a single virus. That accounts for quite a lot of viruses.

A further chemical analysis of the crystals shows that they consist of molecules of oxygen, carbon, hydrogen and nitrogen. Strangely enough, they contain no sulphur or phosphorus like other physiologically active proteins.

CRYSTAL ANALYSIS

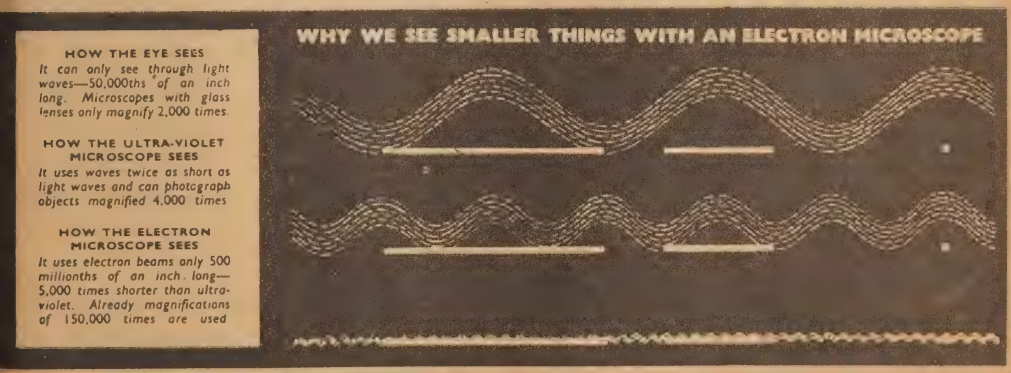
In order to determine the size of the molecules the experimenters resorted to the use of the ultra centrifuge. This is a machine which whirls containers holding solutions at the enormous speed of over 100,000 revolutions per minute. The terrific centrifugal force which is developed sends substances to the bottom of the containers at a speed in proportion to their mass. Thus the molecules in a solution are separated and flung to the bottom of the tube. The process is timed and the period required to separate the molecules determines their molecular weight and size.

By this method it was found that the weight of the tobacco virus was 17-million. Compared with the atomic weight of hydrogen which is one it can be seen that the molecule of a virus crystal is very heavy indeed. Up to that time the heaviest molecule known was that of an animal protein called "hemocyanin," the pigment of earth worm blood. This weighs 5-million.

The tobacco virus crystal must contain millions of atoms in each molecule and in it chemists and other scientists have an admirable subject for further experiment. It is the largest molecule ever found.

Of course we are more interested in

Continued on page 89



Microscopes cannot detect things smaller than a half-wavelength of the mediums they use. The dot at the right can only be detected by the electron microscope.

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Technical Review

AN AIR-LAUNCHED AUTOMATIC WEATHER STATION

A self contained automatic weather station which transmits weather data by radio has been developed by the National Bureau of Standards. Named the "Grasshopper," the device can be parachuted from aircraft on to inaccessible territory.

FTER the station has parachuted to earth, controlled explosive arges are used to disengage the rachute, raise the station to an up-ght operating position, and erect a lescoping antenna. Weather re-onsive devices then cause resistive anges that switch a radio trans-itter on and off at a rate suscep-ble of translation by a receiving ation into temperature, pressure, id humidity readings.

Designed in the shape of a bomb, id packing its own parachute, the eather station is loaded on the mb rack of an aircraft. When the it is released over a desired loca-on, the parachute is automatically ened by a line rigged from the rcraft. Simultaneously an electric ock, which controls subsequent erations of the stations, is turned .

The impact of landing sets off a all explosive charge that disen-ges the parachute and prevents the ation from being pulled along the ground. Either immediately or after a preset dormancy period, another explosive charge causes the station to rise to an upright operating position. This is done through an arrangement of six legs to which springs are attached; the explosive charge operates a release, permitting the springs to pull the legs into position. A third explosive charge extends a telescopic vertical antenna to a height of some 20 feet. The station is then ready for automatic transmission at intervals pre-determined by the built-in timing mechanism.

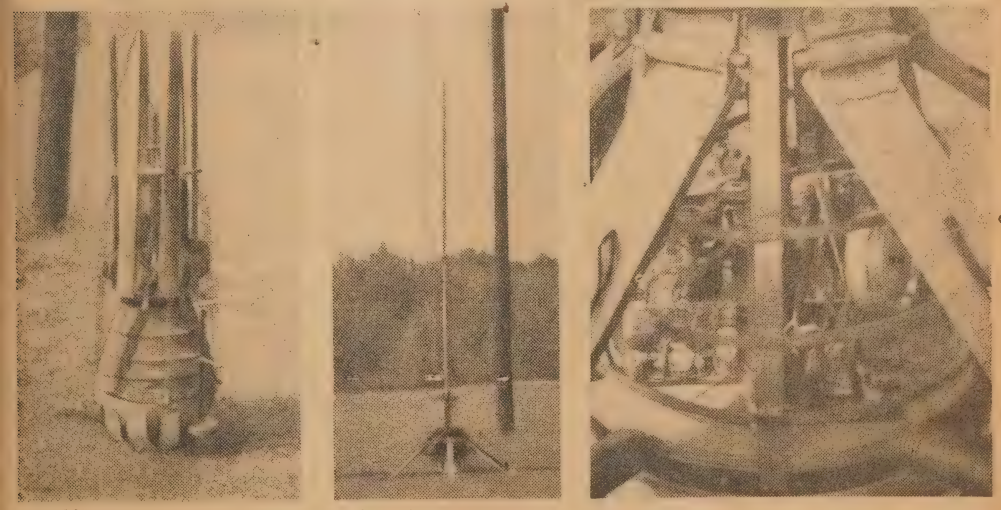
The automatic station could be adapted to transmit various kinds of information; but in the standard design only temperature, pressure and humidity data are reported. Separate mechanisms responsive to changes in these atmospheric conditions cause an associated resistor to vary. At predetermined intervals the timing mechanism turns on the radio transmitter and connects one resistor after another to a critical point in the transmitter circuit. The transmitter is designed so that the emitted radio signal pulses on and off at a rate proportional to the value of the resistor so connected.

The station is calibrated before use by subjecting it to known temperatures, pressures and humidities, and measuring the resulting pulse rates. At the receiving station the transmitter pulse rate can be read as temperature, pressure, or humidity, depending on the phase of the predetermined clockwork cycle.

The radio transmitter proper consists of a crystal oscillator followed by a radio frequency amplifier stage. A relay in the plate circuit of a separate relaxation oscillator turns the crystal oscillator on and off at a rate proportional to the value of whatever resistor is temporarily inserted (by the clock mechanism) into the relaxation oscillator circuit.

The clock, in addition to inserting the several weather responsive resistors into the circuit in a predetermined sequence, connects two other resistors at appropriate intervals. These are a reference resistor and an identification resistor, both

(Continued on Page 33)

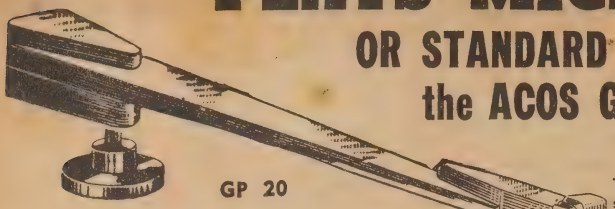


These pictures show (left) the unit as it lands, (centre) after the explosive charge has erected the feet and antenna, and (right) a close-up of the transmitter.

PLAYS MICROGROOVE

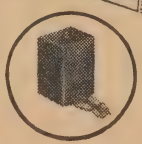
OR STANDARD RECORDINGS

the ACOS G.P.20 Microcell Pickup



GP 20

Inset: The Long Playing Head (GP-19LP) interchangeable with the Standard Head (GP-19).



The G.P.20 pickup is designed for use with th standard 78 r.p.m. records or the 33 1/3 or 4 r.p.m. long-playing microgroove records. To mee these differing requirements, two interchangeabl slide-on heads are available.

G.P.19 head supplied as standard.

G.P.19 L.P. head available for microgroove

It is something new in pickup design and has 20 time greater output than comparable magnetic types, whil needle talk and motor rumble are practically non-existen —permanent sapphire stylus—wide frequency response.

Price — G.P.20 complete with standard head .. **£5/17/6**

G.P.19 L.P. head £3/7/6.

G.P.19 standard head £3/7/6.

GP 10

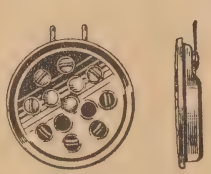
Sturdy construction, ninety degree lift back and exclusive needle pressure adjustment makes this a really outstanding unit in the field of pickups. Has a low harmonic distortion, with an average output of 1.5 volts.

Price £2/19/9

Cartridge only (G.P.9) Price £1/15/-

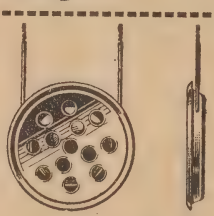
G.P1 incorporates permanent sapphire stylus. Replacement cartridge for ACOS G.P.12 pickup and many American types. Useful frequency range 25 to 12,000 c.p.s. Needle pressure only ½oz .. .. **Price £1/19/6**

Choose your equipment from this famous range!



MIC 14

MIC 14 Standard Speech Microphone Insert with nickel-plate brass case which gives high corrosion resistance, mechanical strength and rigidity. Price £1/18/-.

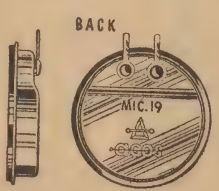


MIC 18

MIC 18 Microphone Speech Insert provides high acoustic qualities with minimum bulk. Where exceptional slimness is required this insert is recommended. Price £1/19/6.

MIC 3

MIC 3 Diaphragm-Actuated Crystal microphone specially designed for the reproduction of speech frequencies. With rising response from 1000 c/s, this microphone has exceptional sensitivity. Price £1/18/-.



MIC 19

MIC 19 Sintercel fulfils the requirement for a flat insert with good sensitivity and a frequency response 40/8000 c/s. Unaffected by vibration, exceptionally robust construction. Price £2/18/6.

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BINAURAL SYSTEM USES A SINGLE RECORD

A recent patent granted to RCA describes a system whereby two separate signals may be recorded simultaneously on the one disc with out loss of playing time, and is suggested as a means of providing binaural reproduction.

TO matter how good we make our reproducing systems the final und always suffers because we e forced to use a single channel id reproducing point, and we can ever "spread" the sound in the me manner as the original. Many tempts have been made to over- me this by duplicating the micro- ne, transmission or recording annel, and the speaker system, and properly done the results can be artlingly realistic. However, the g objection is the need for two cordings or transmission channels, id this has limited most work of is kind to experimental demon- rations.

One method of overcoming this is ggested in a recent patent granted RCA. This enables the two chan- els to be recorded on the same de and in the same groove of an dinary disc so that playing time not sacrificed.

The general scheme may be better nderstood by reference to Figure where A and B represent the two icrophones correctly placed for naural pickup. The signals from icrophone A are treated in much e same way as usual, except that efore being fed to the cutter they ass through a low-pass filter which ts off the response at 8000 cycles. part from the limitation of fre- uency response, this recording is, herefore, a perfectly normal one.

The signals from microphone B are so subject to the action of a low- ass filter, limiting the top response 5000 cycles. Following this is an scillator-mixer system operating on e familiar superheterodyne prin- ple and having a local oscillator requency of 13,000 cycles. Both im and difference frequencies re- lt from this mixing but a follow- g band pass filter system rejects e sum frequencies leaving a band f difference frequencies from 8000 13,000 cycles, representing the riginal 50 to 5000 cycle channel.

CHANNEL SHIFTED

For example, a 50-cycle note will eat with the local oscillator to pro- uce the difference between 50 and 3,000, i.e., 12,950, while a 5000- ycle note will produce the differ- nce between 5000 and 13,000, or 000 cycles. Thus the signals from icrophone B may be regarded as eing "jacked up" bodily to occupy position in the spectrum above at used by microphone A.

The playback arrangement is own in Figure 2, where the full requency output of the pickup is rst raised substantially and then ed to two filter networks, one of hich passes the original 50-8000 ycle band from microphone A rough a second amplifier to speaker

The other filter accepts only the 000-13,000 cycle channel, which arries the signals from microphone , and feeds it to the re-inversion ixer where the signals are re- tored to their original 50-5000

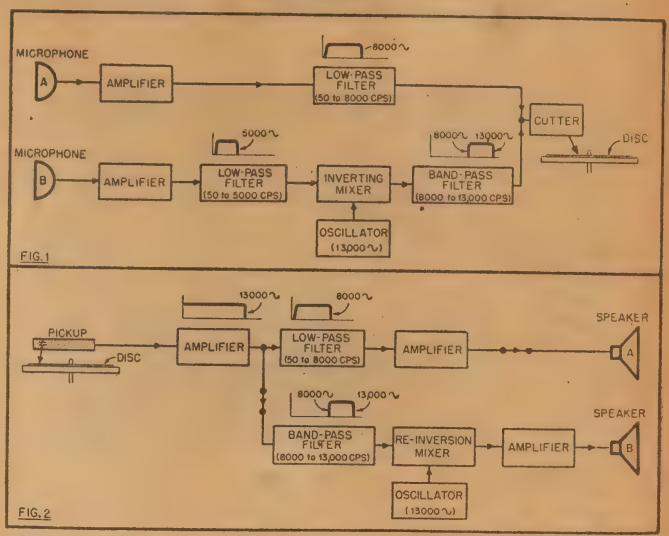

Figure 1 shows the recording set-up where the two channels are separated by the superheterodyne principle before being recorded, and figure 2 shows how they are separated after pickup from the record and directed to their respective speakers.

cycles. After further amplification they are fed to speaker B, thus completing the requirements for a binaural system.

While the scheme has interesting possibilities there are a number of disadvantages and problems to be considered. First, we could only have binaural working with a system like this at the expense of fidelity, and there is some doubt as to which is to be preferred, or whether the added realism would be enough to offset that lost by the restricted range. It would, in fact, have to provide a considerable improvement to justify the added circuit complexity.

Then there is the very real problem of providing a really stable local oscillator, particularly during playback, and also of ensuring that it was at exactly the same frequency as that used for the original recording, otherwise the pitch would vary from the original channel B while channel A would be unaffected —with anything but pleasing results.

Another possible use for the scheme would be to put several different recordings on one disc, the frequency range being restricted still further if only speech was to be handled, thus permitting considerable saving in storage space.— "AUDIO ENGINEERING."

MEASURING COLOR VALUES

THE advent of color television in the US has created the need to measure accurately the spectral composition of colors so that a constant check may be kept on the quality of transmission. This has led to the development of a device which will take direct readings and reduce to a minimum the need for calculation.

Called a "tristimulus photometer," the new instrument uses only five valves and is no larger than a shoe box.

The new device consists essentially of an "eye" and a "brain." The "eye" is made up of a lens which focuses the light under study on to a mirror assembly designed to split the beam into three parts of equal intensity. The three beams then pass through three filters, each sensitive to a range of wavelengths corresponding to the basic color components.

The "brain" of the instrument starts with three photocells, one for each filter. The photocells convert the light energy to electrical energy which passes through circuits, each of a different design, to compensate for the mathematical dissimilarities between the three color components. Finally a corrected value for each component is read on microammeters. —"RADIO AGE."

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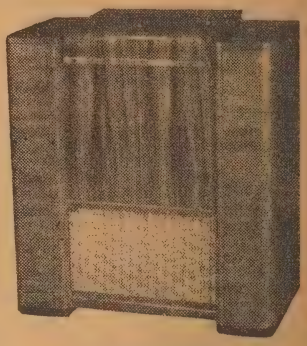

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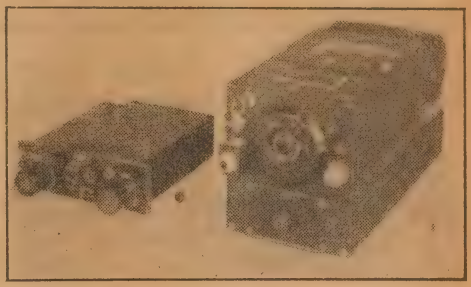
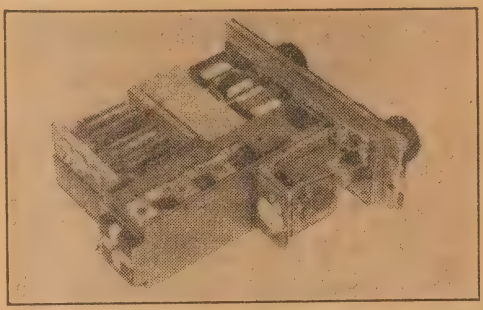
NEW MIDGET AIRCRAFT RECEIVER

A 12-valve subminiature receiver for aircraft covering 190 to 550 Kc has been developed by the National Bureau of Standards electronic miniaturisation group. The unit is a functional equivalent of a World War II unit more than five times as large.



At right is shown the new receiver (left) and the older version which appears to be the well-known "Command" receiver familiar to most amateurs.



Picture on the left shows the unit completed and ready for encasement and sealing in nitrogen gas. The audio output valve assembly is still to be added, and plugs into the socket on the right after the unit is cased. This is to simplify heat and service problems.

ITH the use of more and more electronic equipment within the ited space of military planes and ks, reduction of size has become reasingly important. The Bureau Aeronautics of the Department of Navy has therefore initiated at National Bureau of Standards a ad program for subminiaturisation airborne equipment.

Designed and constructed as part this program, the new low fre-ncy receiver, in conjunction with revious high frequency project (a Kc, 11 valve intermediate fre-ency amplifier assembly), effec-ely brackets the communication ctrum.

The new equipment, a radio range eiver used to keep aircraft on rse, occupies about 55 cubic hes, whereas the volume of the ginal version was approximately cubic inches. Characteristics of receiver include continuous tun-from 190 to 550Kc, intermediate quency of 135Kc, a sensitivity of nicrovolts for 6db signal-to-noise io, and a power output of 100 liwatts.

W H.T.

The 12 valve provides two tuned io frequency amplifier stages, a xer, a local oscillator, two 135Kc ermediate frequency amplifier ges with a band width of about c, a diode detector, an AVC de, a beat frequency oscillator, audio amplifier stage, and a push-l parallel power output stage. All ges operate with 26 volts on aters, screens and plates. Under se conditions of operation, four ominiature power output valves required for adequate power out-.

Unusual design problems were pre-ted by the need for hermetic seal-and the high operating temper-res resulting from the very com-ct construction. Some of the note-worthy features of the equipment are outlined below.

To facilitate mass production, seven detachable sub-assemblies each of which can be built independently, are employed in the receiver. This also permits somewhat easier servicing. The sub-assemblies are fastened to one another and to the front panel which takes the place of a chassis.

Printed circuits are used to a considerable extent. They are of value both in conserving space and for economical mass production. The wiring is "printed" on steatite or silicone impregnated fibre-glass.

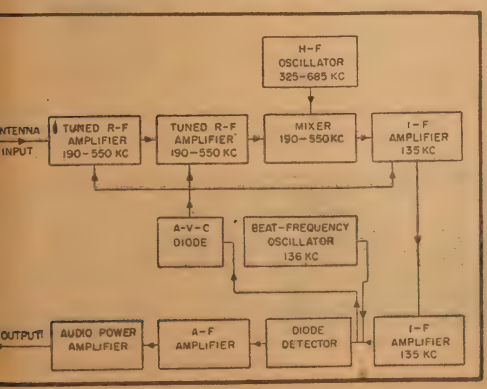
Hermetic sealing of the entire unit affords protection against moisture and contamination. It also permits elimination of protective coatings for the individual components which saves space. A soldered copper band seals the housing to the front panel; this band can be removed for repair purposes with a key of the type used to open food cans. The air in the unit was replaced with nitrogen before sealing to prevent any possibility of oxidation.

The tuning of the receiver over its wide operating frequency range was a difficult engineering problem. A straight line tuning characteristic (frequency proportional to control angle) was required, and this could best be attained in the limited space allowable by the use of a variable pitch screw to drive the slugs in and out of the radio frequency coils.

COILS

The intermediate transformers have an overall size of ½ by ½ by 1 3/8 inches. They are double tuned and use permeability tuned inductors of about 2.8 millihenries which have Q's of 70 at 135Kc. The resonating capacitors are washer shaped and mounted in the ends of the transformers. The radio frequency coil structures resemble those of the intermediate frequency transformers so that similar parts may be used in both.

Apart from its inherent usefulness as an ultra compact piece of airborne communication equipment, the new range receiver has also served as the focal point for the development of several novel components and fabrication techniques. These components, engineered to meet the rigorous size and temperature requirements of sub-miniature equipment, may well afford superior permanence and reliability when used in equipment of more conventional and less compact design.—"NATIONAL BUREAU OF STANDARDS."



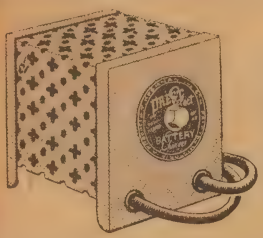
☆

The block diagram of the new receiver shows that it is of conventional electrical design, the main differences being in the method of construction rather than the circuit. Of the 12 valves used four are required to deliver sufficient output with the moderate HT supply.

☆

The WARBURTON FRANKI Page

Everything for the Radio Hobbyist. Check it each month



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20 watt power resistors all values each _____ **7/-**

British aerial wire covered and stranded in 100ft. cartons each _____ **9/-**

Philips air trimmers, each **3/6**

Jabel trimmers, each _____ **1/9**

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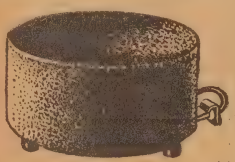
Record cleaning pads, each **4/3**

Q plus car radio coil-kits each _____ **84/-**



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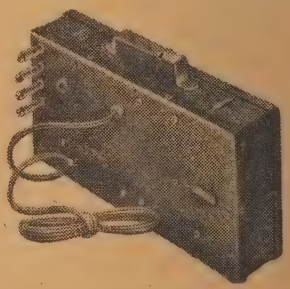
By Goldring fitted with Garrard motor, leatherette case with record and needle holders. _____ **£16/10/-**

BRITISH B.S.R. GRAMO MOTORS & TURNTABLES

2 speed—78 and 33 1-3 R.P.M. Model MU10 _____ **£5/10/-**



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NEWS AND VIEWS OF THE MONTH

Artificial Radium"

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ducts of atom-bomb research is
production of radio active mater-
s for medical use, these replacing
tural radium which is scarce and
ficult to locate.

Tremendously powerful, but non-
plosive "bombs" of artificial radium
ve been offered to American in-
stry by the Atomic Energy Com-
ssion and the Brookhaven National
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Each "bomb" is equal to all the
dium in the world before World
ar II.

The "bombs" are composed of the
etals cobalt and tantalum. Both are
ade radioactive in the Brookhaven
mic reactor which started work
st a year ago.

The cobalt rays last for years. The
ntalum rays are short-lived, half
them dying in about four months.

Both these sources of radioactiv-
will remain at Brookhaven, safely
elded. Industrialists and scientific
stitutions are invited to send to
laboratory at Upton, New York.
substances they wish to expose
the cobalt or tantalum radioactiv-
.

EW PLASTIC

Intense radioactivity causes chemi-
l changes in molecules, speeds up
actions, and may change properties
solid matter.

An example is a new plastic created
Brookhaven with these powerful
ys. Neither heat, pressure, nor the
talysts commonly used by the
stics industry were needed.

The artifical rays merely change
all molecules into large ones. That
the same principle on which nylon
made, but not by rays.

Columbia University is using
nilar rays to study food preser-
vation. Massachusetts Institute of Technology is using them to kill bacteria.

Yale is using them to explore the reaction of gases and the University of Michigan uses them on physical and chemical reactions.

★ ★ ★

The moon soon

HUMANS will make the first piloted return flight to the moon before the end of the century, the British Interplanetary Society predicted.

Such a flight could be made in half that time if an effort as great as on the atom-bomb were made.

Space flight scientists from all over the world will discuss the project at the second International Congress on Astronomics (navigation to the stars) in London from September 3 to 8.

Main theme of the conference will be building an "earth satellite vehicle" which was seriously considered by Nazi Germany during the war and now is seriously considered by the US.

The society described the program as "nothing less than the greatest adventure awaiting mankind."

★ ★ ★

Up 135 miles

ANOTHER milestone on the rocket projectile road was marked during the month by a US Navy Viking rocket which soared 135 miles into the stratosphere. At New Mexico it broke all records for a single stage rocket, reaching a speed of 4100 mph.

Ten minutes after launching the rocket hit the earth about 41 miles north of its launching platform.

When it had descended to 40 miles from the earth a radio signal blew the rocket in two.

This slowed its fall and aided salvage crews to recover the recording instruments.

This was the seventh Viking rocket that US Navy scientists have launched into the stratosphere from the testing grounds at White Sands (New Mexico).

The Viking was 48ft long, weighed about five tons, cost £90,000.

Technical difficulties delayed the launching recently and the liquid oxygen used in the rocket engine was renewed.

When launched the rocket at first seemed to stand still in the air, then zoomed off into space.

RECORD BROKEN

Previous height record for a rocket of this type was 114 miles, made by a German V-2 fired in New Mexico in 1946.

The record for a two-stage rocket —more than 200 miles—was established by a "W.A.C. Corporal" launched from a V-2.

The scientific officer in charge of the Rocket Project (Milton Rosen) said that the Viking's maximum horizontal range would be about twice its altitude record.

This means that as a war weapon the Viking would have a cruising range of 270 miles.

★ ★ ★

Outstanding broadcasts

BROADCAST highlights of the month, and for that matter of many months, were the recordings from the Beyreuth Wagnerian festival heard from the National stations.

The operas of Wagner are on such a titanic scale that only a superlative performance can carry them. In the hands of mediocre performers they can sound unconvincing and interminably dull. In the hands of

POPULAR SCIENCE QUIZ

Q. Is the whale the world's largest fish?

A. A whale is not a fish, but a
mammal, like cows, dogs and human
eings. It is the largest animal,
eaching a length of more than 100ft
nd a weight of over 200 tons.

The largest true fishes are the
harks. One species, the so-called
whale" shark, reaches a length of
0ft, while the basking shark may
neasure some 30ft. These two
pecies are not the most dangerous.
or they, as well as some others, are
ble to feed only on small animals
vhich they sieve out of the water
y special mouth parts. There are
maller sharks which are equipped
vith large sharp teeth and are cap-
ble of biting off a man's arm or
eg.

Q. What causes suction?

A. Suction is really an effect of air
ressure. In the familiar example of
rinking a soda through a straw, you
se your lungs to draw air from
our mouth and to create therein a slight vacuum. That is, the pressure of air inside the mouth is slightly less than that outside. The upper end of the straw is in this region of reduced pressure. Normal air pressure, about 15 pounds per square inch, is exerted on the surface of the liquid in the glass, and this pushes on the liquid, forcing it up through the straw. It seems as if you are pulling the liquid up, much as you might pull up a rope to a high place, but actually, it is the air pressure that is pushing the soda into your mouth.

Q. Is it true that owls hoot and cuckoos call before it rains?

A. A number of birds, including the owl and cuckoo, are very sensitive to changes in the weather and often begin calling when the sky begins to be overcast. Though they are responsive to such changes, and may notice them even before a human, this should not be regarded as an ability to prognosticate the weather.

Q. There is an animal called the eyra. What is it?

A. It is a wild cat found in Central and South America from northern Mexico to southern Brazil. It is as big as an ordinary "domestic" cat, but has an elongated body and is reddish in color. It is believed that it attacks fowls.

Q. How does a thermos flask maintain over a long period the temperature of a liquid poured into it?

A. The thermos flask is actually one container inside another and separated by a near-vacuum. The presence of this "empty" space considerably reduces the loss by conduction of convection of the temperature of the liquid in the inside container. As a further precaution, both the inside and outside walls of both containers are silvered to prevent loss of heat by radiation. This same principle will apply in preventing a cold liquid from getting warm, that is rising to ambient temperature.

masters they are given warmth and light which lift them into a special world of their own.

At Beyreuth were gathered probably as fine a band of Wagnerian artists as Europe has to offer, and that may well mean the world.

They were in company with a specially picked orchestra to whom the operatic scores were an open book, if the broadcasts are taken as proof.

The records were made at the actual performance, and were so skilfully handled that if anything this enhanced the realism of the whole.

But the quality of the performance was something we are not likely to hear again for many a day. It was so good that until a better performance is heard one cannot easily refer to any standards for criticism.

Not only were the soloists and the chorus cast and rehearsed to perfection, but the orchestra, an ever-present and integral instrument, was a sheer delight. The conductor achieved a magical balance which made its presence firmly felt even when it was no more than a whispered accompaniment. Its flexibility, so vital in threading through the mosaic of motif and music, was never at fault. Particularly in the "Meistersingers"—many of us surely heard this magnificent opera for the first time as it should be played.

It seems tragic that the conditions of broadcasting allow only one performance in Australia and call for the destruction of the records before the end of August. There are doubtless good reasons for this. One can only hope that these include the exercise of recording rights which might result in discs being available so that the extreme beauty of the performance will not be lost.

Those who create fine things of this standard have more than a duty to themselves. This is artistic performance of the highest order, and should no more be relegated to the dust than a great painting after its initial exhibition.

We do not envy those whose fate it is to break up these records.

★ ★ ★

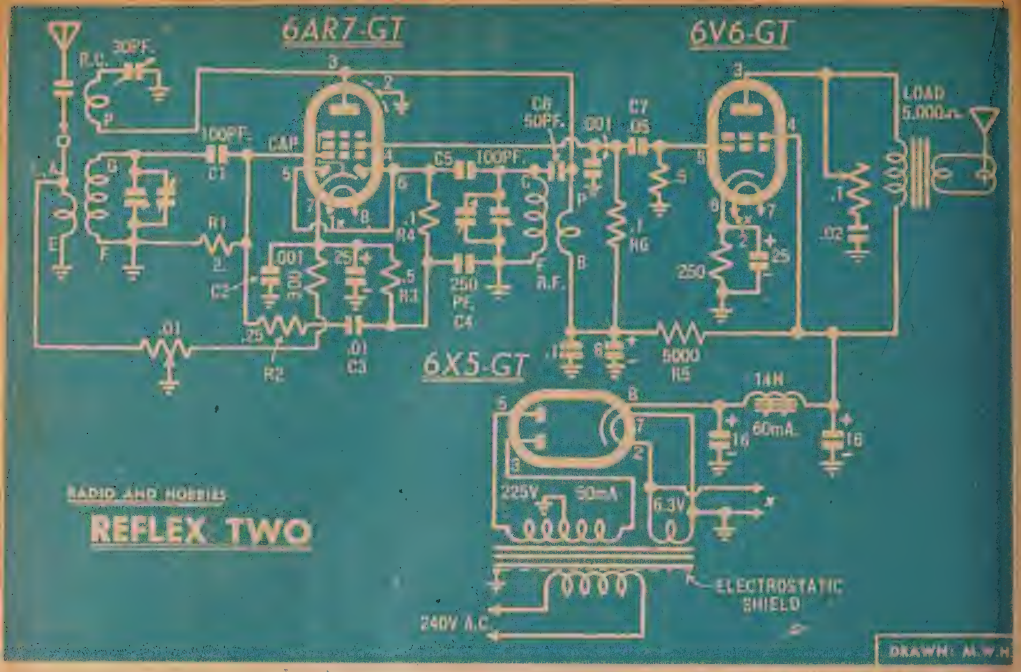
Deadly effects of sound

SOUND waves can give mice running fits and seizures, can tear the one-celled paramecia to bits, and can cause new genetic mutations in plants as late as the third generation after exposure to the sound.

When exposed to a high pitched whistle of about the same sound pressure as the noise inside an airliner cabin, young mice have fits or convulsions. Older mice are not affected, and there is a considerable variation in susceptibility even among young mice from the same litter, according to Dr. Hubert Frings and Mabel Frings who did the research as the Pennsylvania State College.

Paramecia, which are small one-celled animals living in the water and easily visible under a microscope, are destroyed by a sound at a pitch of 1200 cycles per second.

It is believed that the tiny cell, with its contents and elastic covering membrane, has a natural vibration frequency at this pitch. High intensity sounds of other pitches are not nearly so effective in killing the one-celled animal.



The circuit is rather more complicated than last month's, but if you study it carefully in conjunction with the article you should have no difficulty in following it.

LEARN WHILE YOU BUILD

The sets described so far in this series have been relatively simple to build, but have had their own little tricks of adjustment when it came to using them. This is all right for the fellow who makes them—his enthusiasm will soon overcome any troubles of this kind—but is not so good for the other members of the household. This month's design may not have much greater sensitivity, but it handles like a normal set and is simple enough for anyone to use.

by Philip Watson

WITH the set described last month you should be able to receive your local stations at good speaker strength and with all the fidelity that can be expected from a speaker and cabinet of such modest size.

Now the question arises—where do we go from here?

Have we reached the ultimate for a set using only two valves and rectifier, or is it possible to get substantially better results with improved circuits?

Which in turn raises the point as to just what constitutes "better results." When the set will receive all the local stations at full room volume and free from interference, there will be many who will consider that there is little point in going any further and, in many cases, this is true.

On the other hand, we must consider the non-technical members of the household and the problems which arise in handling a set of this kind. Good though the results are, they are mainly dependent on the skill of the operator and the lady of the house will not always take time off to learn how to handle a regeneration control.

As far as actual performance goes—the ability to receive signals—we have thus just about reached the limit for two valves, but there is room for improvement in other directions, mainly ease of handling.

Since it is the need for careful and frequent adjustment of the regeneration control which causes most of the bother, we must try and dispense with this feature, at least as a panel control, and find some other way to provide the required gain.

One method is that known as reflexing, that is, the use of one valve to amplify the signals twice, once at radio frequencies and again at audio frequencies.

If, at the same time, we can provide a second tuned circuit, there is a good chance that we will retain the selectivity previously due to careful regeneration control, and this is the basis of the present design. Actually we are still retaining some regeneration but the amount is fixed and the extra gain, while worth while, is not as great as when it can be adjusted individually for each signal.

At first glance the circuit may appear unduly complicated but, if the purpose of each section is taken stage by stage, you should have no difficulty understanding it and, when it comes to the actual construction, it simply means that there are more parts to be fitted. At the same time it must be realised that we can only get improved results at the expense of greater circuit complexity, particu-

larly when we are making one valve do two jobs.

The power supply and power output stage remain essentially unaltered, the changes being concentrated around the 6AR7. The input from the aerial is applied to a tuned circuit consisting of one "Reinartz" coil and one section of the gang condenser, the lead from the primary to the 10,000 ohm potentiometer being ignored for the time being.

The signals applied across the tuned circuit are applied between grid and cathode of the 6AR7 and, up till now, the circuit appears much the same as it did before. Note, however, that the grid leak and condenser are no longer used and this, in conjunction with the 300 ohm bias resistor in the cathode circuit, means that the valve is now operating as an RF amplifier, rather than a detector.

RF AMPLIFIER

Thus the signals appearing on the plate circuit take the same form as those applied to the grid except that they have greater amplitude. These are now applied to a second tuned circuit consisting of an RF coil and the second section of the gang condenser. The RF coil is somewhat similar to the "Reinartz" coil, but has no feedback winding.

From here the signals are applied to the diode circuit and are detected, the general arrangement being the same as that used in the "Twin Tune One" (June, 1951). In our present circuit the .5 megohm resistor is our diode load and the .1 megohm with the 250 pf condenser is used to filter out the RF component.

So far, we have followed fairly standard procedure, using the 6AR7 as a combined RF amplifier and diode detector and the audio signals across the diode load resistor could be applied to the grid of the 6V6, or an audio amplifier stage and then the 6V6. An audio amplifier is really essential, however, as there would be insufficient output from the detector adequately to drive the 6V6.

Now we come to the reflexing part of the circuit. Instead of using a separate valve as an auido amplifier we use the same valve as has already served as RF amplifier. From the junction of the .5 and .1 megohm resistors a .01 mfd condenser provides a path for the audio signals to the grid of the 6AR7, the 2 megohm resistors completing the grid circuit at audio frequencies.

AUDIO LOAD

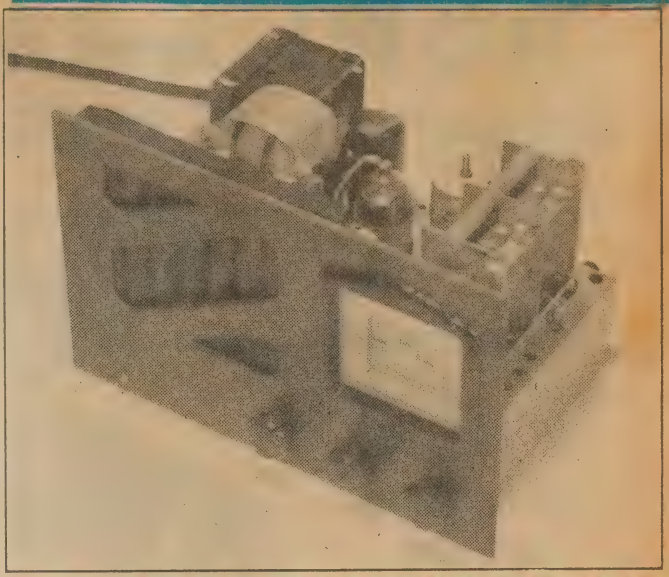
The amplified audio signals will now appear in the plate circuit and, if we provide a suitable load at audio frequencies, such as a resistor, audio voltages will be developed across it. This method of picking out the signals is often used, but it has the disadvantage of reducing the voltage applied to the plate of the valve and thus restricting its efficiency as an RF amplifier.

A more recently developed scheme avoids this complication by taking the audio signals from the screen circuit, the valve operating as a triode at audio frequencies. While the gain of a triode will be less than that available from the pentode, this is offset to a large extent by being able to operate the RF stage at full efficiency.

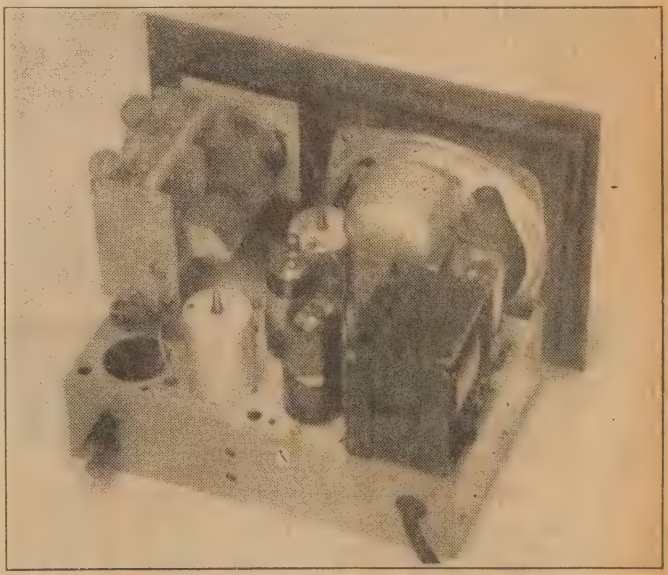
This idea has been used in our present set, the normal screen dropping resistor (.1 megohm) serving as the audio load and the screen bypass being reduced to .001 mfd. This value is fairly effective at RF but will have small effect on audio signals. The .05 mfd condenser is the normal coupling condenser to the grid circuit of the 6V6 and, from here on, the circuit is quite conventional.

The volume of the set is controlled by means of the .01 megohm potentiometer which reduces the sensitivity of the set in two quite different ways. Ignoring for the moment the connection of the aerial, it will be seen that any resistance

FRONT AND REAR VIEWS OF SET



This front view gives you some idea of the altered layout. The RF coil is at the rear of the chassis and the Reinartz coil can just be seen behind the speaker baffle.



The Reinartz coil can be clearly seen in this picture between the speaker and the 6AR7. The 6V6 is in the same position as before and the extra coil is alongside it.

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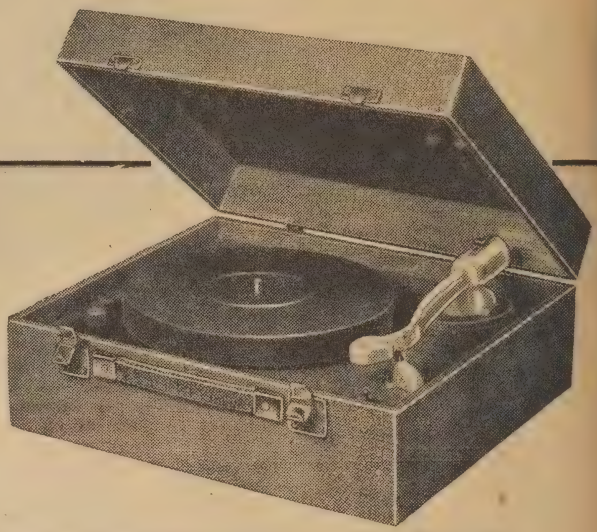

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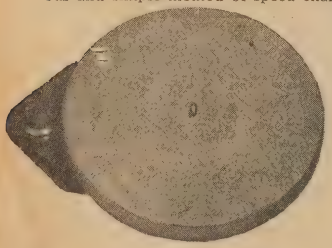

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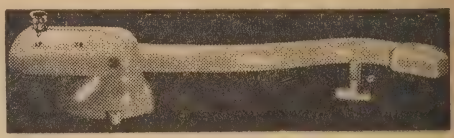

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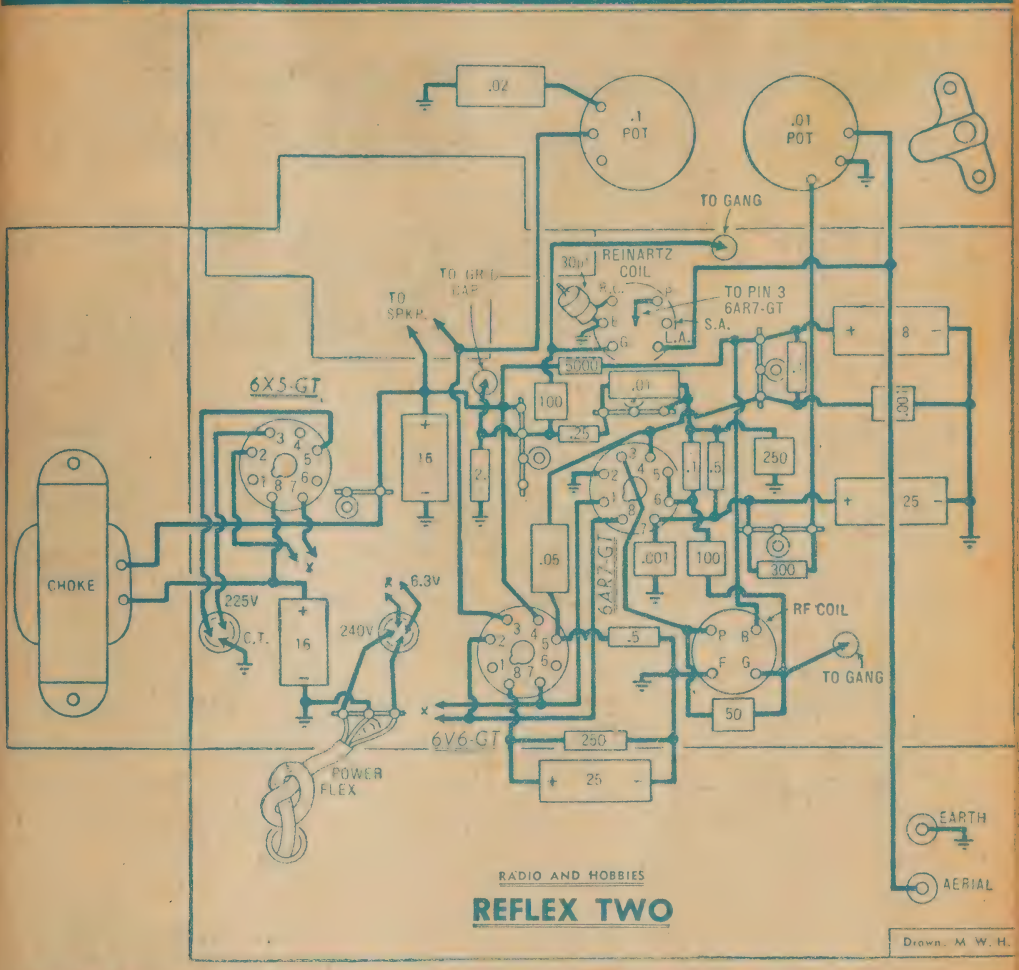
A COMPLETE WIRING DIAGRAM FOR THE NEW SET



This wiring diagram should help in the placing of the parts, especially around the 6AR7 where there are rather more than usual.

between the right-hand end and the moving arm will be included in the cathode circuit of the valve and, as it increases, so will the bias increase.

This reduces the gain of the valve for both audio and RF and in many cases, would provide sufficient control. In other cases, particularly close to powerful transmitters, difficulties may be encountered. If we apply a strong signal to a grid which has a high bias, it is likely to become quite an efficient detector, instead of an RF amplifier, and, at the same time, it will not be able to operate correctly as an audio amplifier.

By connecting the other end of the control to the aerial the incoming signal will be controlled before it is applied to the grid and as the moving arm is moved closer to the aerial end, this signal is made less as the bias is increased, making it possible to control strong signals without applying excessive bias.

As already mentioned the regeneration circuit is still used, but the control is in the form of a small trimmer condenser which is preset to give as much regeneration as possible without spilling over on any desired station.

EXTRA PARTS

- 1 8 mfd 500V electrolytic.
- 1 25 mfd 40V electrolytic.
- 1 300 ohm 1 or 3 watt resistor.
- 1 .1 meg 1 watt resistor.
- 1 2 meg ½ watt resistor.
- 1 .2 meg ½ watt resistor.
- 1 5000 ohm 1 watt resistor.
- 1 .01 mfd 400V paper condenser.
- 1 .02 mfd 400V paper condenser.
- 1 250 pf mica condenser.
- 1 .001 mfd mica condenser.
- 1 50 pf mica condenser.
- 1 10,000 ohm wire wound potentiometer
- 1 RF coil.

Scrap of alumunium for coil mount. nuts, bolts, solder lugs, &c.

This leaves only two main controls tuning and volume, which will operate in exactly the same way as on any conventional receiver of four o five valves, and a tone control which can usually be left alone once the desired setting has been found. The tone control circuit is a .1 megohm potentiometer and .02 mfd condenser from the plate of the 6V6 to chassis.

Some additional filtering was found necessary to keep the output free from hum, and this is provided by the 5000 ohm resistor and 8 mfd electrolytic. This is known as a decoupling circuit and is also useful on occasions to prevent unwanted coupling between stages having a common power supply.

In this case the electrolytic provides the additional filtering to the 6AR7 circuits, which have only light current requirements, while the 5000 ohm resistor isolates it from the main power supply which has to deliver considerable power to the 6V6.

The 50 pf condenser between the windings of the RF coil (G to P

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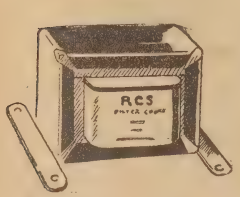

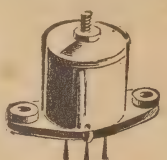

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H126 10 metre Air Core Osc.
H127 20 metre Air Core Aer.
H128 20 metre Air Core R.F.
H129 20 metre Air Core Osc.
H130 40 metre Air Core Aer.
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H138 B'cast Unshielded Osc.
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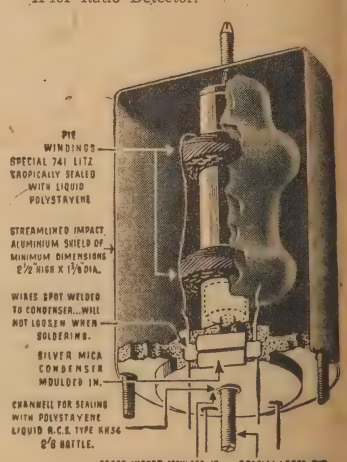

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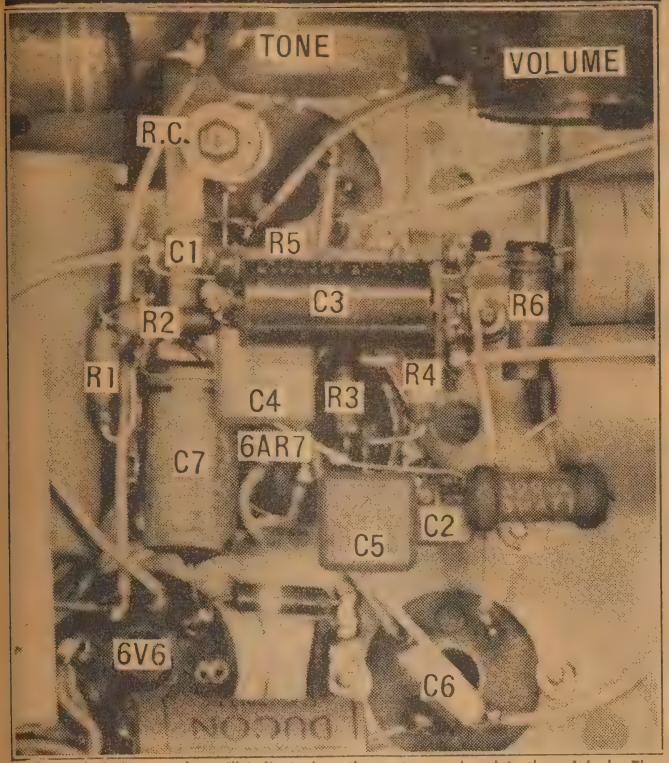
CLOSE-UP VIEW OF THE WIRING



This coded close-up shot will indicate how the parts are placed in the original. The figures correspond to those on the circuit diagram.

increases the coupling slightly at the high frequency end, where we found there was a slight falling off in sensitivity. With things evened in this way it is possible to arrive at a better setting of the regeneration control, since its effectiveness is largely dependent upon uniform gain in the receiver.

Whether or not this condenser is required will depend to some extent on the type of RF coil you purchase. The best plan is to try it and either instal the condenser or leave it out — whichever gives the best results.

The construction calls for quite a deal of alteration, mainly in the location of the 6AR7 and the "Reinartz" coil. The chassis as originally punched has a valve socket hole at the front near the speaker cut-out and another hole for a coil immediately behind it.

At first we tried to arrange a layout using these two holes as originally intended, but it soon became obvious that this would not be very satisfactory, calling for long leads with every possibility of undesirable coupling between them. However, when the positions of the valve and coil were reversed a far more logical layout became possible, and it was decided to adopt this, even though a little extra work is involved.

After all, we reasoned that the purpose of the series is to educate by practical means and there is something to be said for the extra bit of dismantling and rebuilding.

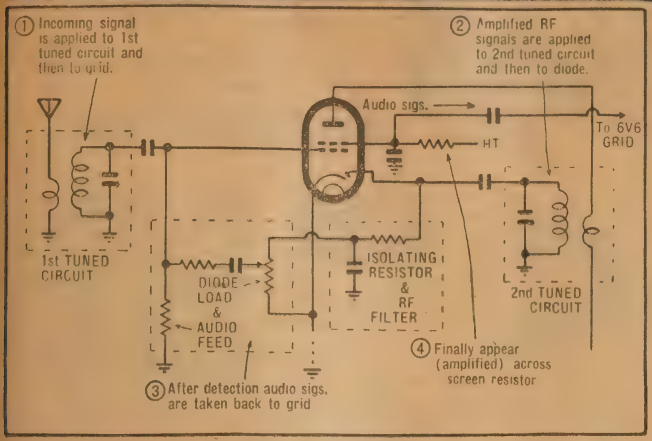
The valve socket is easily accommodated under the coil hole, it being merely necessary to drill two extra bolt holes so that it is mounted with the filament pins toward the 6V6 socket. The coil is not quite so easily handled, the usual socket hole being too large, and it will be necessary to fit a small aluminium plate having the correct size hole (1" to 1⅛"). Ours measured about 1⅝" by 2" and was mounted on the underside of the chassis.

The RF coil is now located at the rear of the chassis in the position previously occupied by the Reinartz coil, while the volume control mounts in place of regeneration control. As many as possible of the larger components — electrolytics, by-pass condensers &c.—are mounted to one side of the 6AR7 socket immediately beneath the gang condenser. This leaves room close to the socket for the various small components which make up the coupling circuits and which should have the shortest possible leads.

To make for easier wiring it is strongly recommended that half watt resistors be used, except in the case of the 5000 ohm decoupler and the .1 megohm screen resistor. Elsewhere, the 1 watt size will prove rather awkward. Likewise the smaller mica condensers, such as the P/T type, will help, and it is worthwhile going to a little extra trouble to get these items.

As will be seen from the wiring

HOW REFLEX CIRCUIT OPERATES



A simplified diagram to show the path of the signals through a reflex circuit. Only the main components are shown in the interests of simplicity.

diagram there are several tag strips used to help mount the components, and these are really essential if various bits and pieces are not to be left floating in mid-air.

Since we are using two tuned circuits which must be kept in step, we will need trimmers across each section of the gang. Those who have followed the series from the beginning will probably have left these in place after the "Twin Tune" Crystal set, but those who started later will need to fit them now.

A third trimmer is needed to control regeneration and this will be mounted under the chassis as close as possible to the coil connections. We found one of the small concentric type most suitable, as it could be mounted directly between the two coil pins "RC" and "E". It is important to connect this the right way round, with the centre connection to the earth pin, otherwise you will experience capacity effects when it is being adjusted.

With all the wiring completed, make a careful check against the circuit before switching on—after all this is your biggest set to date and a mistake would be quite excusable.

ADJUSTMENTS

If every thing appears correct set the regeneration trimmer to the minimum capacity position and switch on. If all is well you should have no difficulty in receiving your local stations, though perhaps not quite as well at this stage as with the "Reinartz Two." However there are a number of adjustments to be made before the maximum performance will be obtained.

Begin by setting the regeneration trimmer to minimum capacitance. Now tune in a station at the low frequency end of the band (2FC or thereabouts) and adjust the iron-dust core in each coil for maximum volume. These cores are attached to brass screws which protrude from the top or bottom of the coil, and, as their position with relation to the coil is varied, the inductance of the coil is also varied. This makes it possible to adjust each tuned circuit to the same frequency at this end of the band.

Next select a station at the high frequency end (say 2SM) and adjust each of the trimmers for maximum volume.

Now, with the volume control fully advanced and the set working with a normal aerial you may proceed with the adjustment of the fixed regeneration.

REGENERATION CONTROL

Screw in the control trimmer while tuned to a station until the set oscillates, then back it off slightly until that station may be tuned in smoothly with maximum volume but no sign of oscillation. Now check each station on the band and if necessary reduce the regeneration on any which tend to spill over, finally arriving at a setting which will allow all stations to be tuned in without oscillation and with the volume full on.

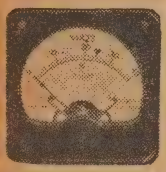
This adjustment will have a slight effect on the first tuned circuit and for best results it is well to go over the alignment procedure again, particularly at the high frequency end. When all this is completed it should be possible to tune in each station quite smoothly, and simply adjust the volume control to suit your requirements.

As with most small sets the aerial length or aerial coupling has a pronounced effect on performance and it is well worth while with this set, as with those previously described, to experiment with this factor until the very best results are obtained. We conducted our experiments with the same aerial as was used for the "Reinartz Two" and this should provide a good starting point, but with room for experiment to suit the individual case.

Too long an aerial will cause interference between stations and where there are powerful ones nearby a few feet of wire around the picture rail will be all that is required. In outlying areas the weak signals will call for a more efficient aerial, but height is more important than length, which if too great will cause difficulties by loading the regeneration circuit and preventing proper feedback.

Homecrafts PTY. LTD.

BARGAINS FOR THE RADIO ENTHUSIAST



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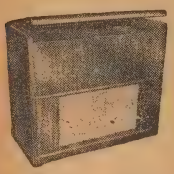

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Model with deep well for a record changer, £16/17/-.

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5BP1 Cathode Ray Tubes originally cost £15/-/- cut to only 37/6.
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Socket for 5BP1 tube, 9/6.
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Power Transformer for 5th Cathode Ray Oscillograph, £8/19/6.

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2	,,	800v work.	3/9
1	,,	1,500v work.	5/11
.25	,,	6,000v work.	3/11
.25	,,	400v work.	2/9
.25	,,	2,000v work.	3/6
.1	,,	6,000v work.	2/11
.02	,,	8,000v work.	4/11
.1	,,	600v work.	1/11

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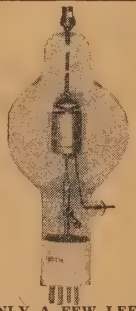
DISPOSAL VALVE BARGAIN

Valve used most in Television receivers. Type EF50. 15/-.



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Brand new American imported Eimac 100th Transmitting Tubes. Reduced from 8 Gns. to only 49/6.

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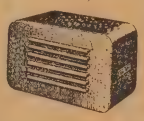
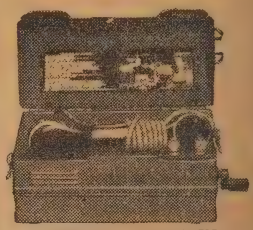
The best quality chassis punch in Australia. Made of best case hardened steel. Price, as illustrated, for standard 1⅛" hole, 43/6. For miniature valves, 21/6. For the new Innoval Series, 28/6.



NEW CAPITOL OVAL EXTENSION SPEAKER

Incorporating the new Rola 69L oval speaker in streamlined steel cabinet with Black, Grey or Cream crackle finish. Complete with Switch as illustrated. 4 Gns.



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English Army Telephones, generator type with bell. No batteries required. Five mile range. As illustrated. Complete, only £4/17/6.

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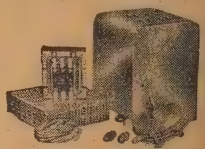
Acoustic type portable gramophone with double spring motor, in leatherette covered carrying case. £14/19/6. Terms: £3/-/- deposit, 5/- weekly.



BATTERY CHARGER KIT

Kit of parts to build a 6 volt 4 amp. Battery Charger. Kit includes an English Selenium Rectifier, Transformer, Black crackle finish Metal Case, two Terminals, Hook-up Wire and Circuit Blue Print Instruction. 12 volt 2 amp, 5/- extra Price, as illustrated. £4/10/-.

I.F. BARGAIN

Brand new Iron Cored 455 Kc. I.F. Transformers. As illustrated, cut to only 8/11.

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WEATHER STATION

(Continued from Page 15).

of constant value. The pulse rate produced by the fixed reference resistor is observed during initial tests of the transmitter. Any subsequent change in this reference pulse warns the receiving station that a correction must be applied to the pulse rates of the weather responsive resistors. Such deviation could arise from transmitter damage or ageing.

The identification resistor is of a value selected to produce a pulse rate characteristic of the particular station. This enables the operator at the receiving station to identify the sending station.

SHOCK PRECAUTIONS

A special technique is used to ensure maximum accuracy of the transmitted data despite possible deformation of the weather-responsive mechanisms due to landing impact: a buzzer vibrates each weather-responsive device for a short time before its associated resistor is inserted in the relaxation oscillator circuit. The forced vibration counteracts friction, which may have been increased by landing impact deformation; this aids in the attainment of true equilibrium condition.

When the station is to be used as a beacon, the radio transmitter and its control mechanisms may be simplified so as to transmit a constant or intermittent signal only.

The development model had an output of the order of 5 watts. Operating on a frequency in the neighborhood of 5 megacycles, it performed reliably over land at a range of more than 100 miles. Dry batteries provided power for transmission of weather reports at 3-hour intervals for more than 15 days.

FACT OR FICTION?

(Continued from Page 11)

both rely upon the extraordinary badness of our eyes from the aspect of a maker of optical instruments.

Who would buy a microscope which had lenses so far from the spherical that a point of light appeared to have streamers rushing from its centre? Yet it is to this fault that a star owes its traditional form.

Would anyone consider a lens and its appurtenances which were so slow in response that the image formed takes a fifth of a second before it died away? It would be a poor advertisement for the manufacturer of photo-electric cells if this was his standard of efficiency.

Now come to the cinema where, incidentally, you sit half the time in pitch darkness while the film moves. Yet you are quite willing to pay the full price.

If your eyes had no retentivity you could never enjoy Donald Duck, and if the last picture came on again before the next took its place, the projection would be worse than those of the earliest biograph.

So you will agree that the world is an interesting place. It is quite impossible to be bored. That is what I think. But if you must trouble yourself with unnecessary figures, and if you insist occasionally upon confusing smartness with intellect, I will give you a problem. . . .

Here's your answer, Tom!

Ever eager to learn, Tom, this month has another series of interesting questions on a wide range of subjects. No doubt you will find the answers to a number of queries that have been bothering you. Take the first one, for instance.

How does a 225 volt "tranny" produce a high tension supply of 235 volts, or even higher than that? I can't understand where the extra volts could come from.

We are very glad you asked that question, Tom, as it is one that we suspect has been troubling other readers. There is no question of an electronic magician pulling the few extra volts from under his electronic slipper, as some may have thought, nor is the phenomenon limited to a few isolated cases. Much the same occurs in the majority of radio receivers.

The 225 volts, at which the transformer secondary is rated, is the RMS or effective value of the alternating output voltage. If you were to draw a graph of the output of one half of the secondary, plotting voltage on the vertical axis and time on the horizontal axis, you would get a series of the familiar sine curves.

The 225-volt line on the graph would be about two-thirds of the distance between the centre line and the peak of the curve. The peak of the curve would actually be 318 volts. This is the highest value to which the voltage rises during any part of the cycle.

The rectifier valve plate is connected directly to the transformer and every time the transformer delivers a positive voltage (every half cycle) it conducts and delivers energy to the filter circuit. Being in sympathy with voltage applied to the plate the cathode potential starts at zero at the beginning of the cycle and rises to a maximum at a quarter cycle.

The cathode of the rectifier does not quite follow the excursions of the plate due to the presence of a filter condenser connected across the output. When it receives the impulse from the rectifier the condenser charges to almost the peak voltage from the rectifier, in this case something approaching 318 volts. On the second quarter of the cycle the voltage from the rectifier drops but the condenser tends to keep the voltage up to the peak level.

If there is no drain on the power supply and the condenser is in perfect condition it will actually stay at the 318-volt level. However, any drain tends to empty the condenser and the heavier the drain, the lower the voltage will drop. Conversely, the lower the resistance of the rectifier valve or the higher the value of the condenser, the higher will the DC voltage tend to remain.

And that's the explanation, Tom, how many power supplies come to deliver a DC voltage higher than the RMS value of the AC applied to the rectifier. Savvy?

In a valve, why is the filament sometimes called the heater?

Sometimes, the one thing can correctly be labelled either filament or heater, Tom, so you will get a clearer idea of the story if we explain how the names originated.

The first thermionic valve consisted of a plate and a thin thread of conducting material in the same envelope. The thin thread of conducting material is called a filament, which is really just another name for thin thread. There's no mystery about this.

As the science of radio developed further, it became desirable to operate the filaments of the valves from alternating current. However, if the AC were applied to the filament directly, the temperature would vary throughout the cycle sufficiently to cause hum in the output.

Some very clever people evolved the idea of covering an AC operated filament with a coating of insulating material and, in turn, enclosing the insulating material in a snug-fitting metal cylinder. Thus, while the filament and metal cylinder are insulated from one another, the filament is able to heat the latter up to a sufficiently high temperature for it to emit electrons. The filament can therefore be called the heater with equal justification in this case.

The filament or its indirectly heated substitute is always connected to the negative end of the circuit and either one can therefore be called a "cathode" which is a name synonymous with negative in electrical circuits.

Modern usage has tended to favor the reservation of the word filament for directly-heated battery operated valves and heater and cathode for indirectly heated valves. We suggest that you stick to this to save confusion.

I have noticed that some vibrators are called synchronous and some non-synchronous. Does this mean that one is a better class job and more costly to fit into the circuit?

You have wandered a little off the beaten track, Tom, but we will do our best to set the wheels running smoothly again.

Synchronous vibrators have a second set of contacts arranged to operate in synchronism with the primary contacts. These contacts can be wired so that the vibrator delivers pulsating DC without the need for a separate rectifier.

A non-synchronous vibrator has no such secondary contacts and the alternating current which it delivers has to be applied to a rectifier if DC is required. You can see, therefore, that the synchronous vibrator saves a valve and for this reason often makes the complete set somewhat cheaper and simpler.

This is not the full story, however, since, when a synchronous vibrator is used, it is important that the polarity of the supply be correct. With a non-synchronous vibrator the polarity of the supply is not important. Manufacturers of car radios often find that is it more convenient to use a separate rectifier to save the bother of adjusting the set for cars of different battery polarity.

Another point is that it is somewhat easier to make very heavy duty vibrators of the non-synchronous type so that large battery-operated amplifiers and transmitters often employ this type in conjunction with separate rectifiers. So you see there is really no question of one type being better than the other—a pencil is useful for writing, but so also is a pen.

Can a cigarette-lighter be used for soldering, because that's about all the equipment I have? I want to build "Tom Thumb" but simply can't afford an electric soldering iron.

A skilled and patient workman over a period of time may succeed in making "Tom Thumb" with the

aid of a cigarette-lighter and a midget iron, but it would need a marathon effort. It's just one of those things. . . . Have you ever tried to lift yourself off the ground with your own shoelaces, Tom? Try it some time and you will see what we mean.

You would be in uncommonly poor circumstances if a cigarette-lighter were really the only source of heat available to you. Even in the old days, we can remember sessions with a plumber's iron in front of the family stove. Of course, miniature components make it a lot harder these days, particularly if the iron gets encrusted with a half-inch layer of soot and ash.

Most hobby or hardware stores sell small soldering outfits these days and the iron can easily be heated and kept clean over the gas stove. You haven't a gas stove? Right then, use a primus stove. You haven't a primus? Well spend a couple of shillings on a spirit stove and a bottle of "metho."

Provided you only want to build a small set, your soldering outfit can be quite modest.

How do you uncouple an amplifier? My amplifier is making popping sounds when the volume is turned up and a friend tells me that it needs uncoupling.

Your friend is probably quite correct, Tom. The coupling referred to is that between successive stages of the amplifier and is present by virtue (or otherwise) of the fact that the successive stages are operated from the same power supply.

When the amplification is above a certain value the coupling through the power supply is sufficient to cause oscillation, which appears in the speaker as a "popping" sound. This oscillation occurs at a frequency which is connected with the natural time constant of the power supply and is generally only a few cycles per second. The lower the natural time constant of the power supply is made the less the chances of oscillation. Incidentally, the "popping" sound is often referred to as "motor-boating."

Translating this into terms of "what to do," a large condenser from the high-tension line to earth is often helpful. The main difficulty is that to be sufficiently effective the condenser has often to be too large to be practical.

This is where the "uncoupling" business comes in. Incidentally, "decoupling" is the word normally employed. The idea is to insert some resistance in the power supply between successive stages and to bypass the amplifier end of the resistor with a capacitor of fairly large value. This resistance tends to isolate the stage from the high tension line of the power supply whilst the capacitor provides a low impedance path to chassis, and hence back to cathode, for the audio currents.

When a decoupling network is referred to in technical articles you can assume that it is the resistor capacitor combination.

In your case, since the amplifier was originally working satisfactorily you can assume that the trouble is caused by deteriorating of some of the components.

First on the list of suspects is the electrolytic capacitor which decouples the voltage amplifier stage. Electrolytic capacitors tend to become low in value with age. There is no need to disconnect it from the circuit. Simply try the effect of another capacitor of the same value in parallel with the first. If this fails to effect a complete cure, try the same scheme with some of the other electrolytics.

The decoupling resistors are hardly likely to cause the trouble since they tend to become high, rather than low, in value with age.

In the case of a transmitter/receiver, is it necessary to have a special type of receiver?

In general, Tom, the answer to your query is no. There need be nothing special about the receiver except that it is usual to render the receiver inoperative in the "transmit" position. In most cases this is simply a matter of switching off the high-tension supply. The heaters are left running.

However, most receivers used in conjunction with transmitters for communications work have a number of features which would not be found in a domestic receiver used purely for entertainment. These include the provision for rendering the receiver inoperative as already mentioned and in addition provision for the attachment of headphones is often desirable. Some communication services require a signal strength reading device such as a meter or magic eye to assist in accurate tuning, in addition to measuring the strength of incoming signals.

The description "communications receiver" is often misused. Strictly it could be applied to any receiver used for communications work, even if it were only a crystal set.

Amateur communications receivers are usually designed for excellent performance within the limits of the relatively narrow amateur frequency bands. The design of the tuning circuit is greatly simplified if the amateur bands only are to be covered but, if the selectivity of the receiver is to be useful, great care must be taken to see that the receiver can stay tuned accurately to the required frequency. It is useful to have the dial accurately calibrated in terms of frequency so that other stations can be advised of their relative positions in the band.

BANDSPREAD

Some of the amateur bands are very crowded and a highly selective intermediate frequency channel is desirable, particularly in the case of morse code reception. The desired result can be achieved with a succession of intermediate frequency stages using specially-designed coupling transformers. When a very high order of selectivity is required some special provision such as a crystal filter or double superheterodyne arrangement has to be adopted. This is an involved topic in itself.

Most communication type receivers would include a beat oscillator of some sort so that unmodulated morse code signals are made audible. The better and more expensive types would also include a crystal hand-setting oscillator so that the calibration of the receiver can be checked at regular intervals.

A commercially-made communications receiver is often a very expensive item running into many hundreds of pounds. It may not look in the least like a domestic radio receiver.

Let's Buy An Argument

After all that's been said in this magazine about pickup characteristics, compensation and so on, it is staggering to find that some readers are still blissfully unaware of the important basic facts and requirements. Either they haven't properly digested the relevant articles or they're new readers. I can only hope that this latter is the case, for the sake of our collective ego!

by W. N. Williams

ONE comes across quite a few instances of this "not-reading-the-article" business and, strangely enough, the worst offenders are often beginners. Time and again we are asked about this or that, and the inquirers look most surprised when we refer them to a certain chapter and verse in the article they're supposed to have read.

One would need to be more than human to anticipate all the difficulties that readers might encounter, and some queries are inevitable. That much is obvious, but from the reader's point of view it is surely most logical and essential to digest thoroughly what is said before embarking on a new project.

Now I don't know anything at all of the first correspondent (J.A.), whether he is a new reader, an old reader or a constructor who came by a copy of a much-talked-of circuit. But this I do know—he has obtained precisely the results one would expect from the particular combination of components. Let's see why.

Basic unit in the set-up is an 807 triode amplifier which, aside from its circuit complexities, is beyond reproach as far as frequency response and distortion content is concerned. From input to output it is truly flat and, barring accidents, the most careful laboratory tests will only confirm the inevitable.

Now into this is fed a Goldring "Headmaster" pickup which, apart from a few inevitable bumps, also has a substantially level response curve. Much the same could be said, with variations, for any one of a half-dozen other brands of magnetic pickup.

Put the pickup and amplifier together and you have a substantially level response from needle to speaker over the main audio range. Nothing more could be required, surely?

But the vital point is that the music impressed on the record does not in itself have a "level" characteristic. Below a certain frequency, which might be anything from 250 to 1000 cps, the bass response is deliberately tapered off at a rate which may be as high as 6db per octave.

In other words, that 30-cycle organ note which is fed into your "level" pickup and "level" amplifier is attenuated beforehand by at least 18 db and possibly more. The reproduction simply MUST sound thin unless something very definite and very deliberate is done about the falling bass response.

STRANGER THAN FICTION

As I said before, it seems incredible that anyone keen enough to spend money and time on an amplifier should still be unaware of this elementary and fundamental fact, but there it is! At least a half-dozen times in the past fortnight I've come across the situation—hence these further remarks about this thread-worn subject.

Of course, some folk get very impatient about the whole question of compensation, tending to regard it as an invention of the Devil, or the manifestation of some hidden and ulterior motive. A Victorian reader, Mr. E. Luke, puts it this way:—

"As far as reproduction is concerned, the record is the starting point and everything we desire should be on that disc. If I could buy a 10-inch disc of a theatre organ which had the very low frequencies without distortion, but which ran for only two minutes, I would prefer it. Quality is of first importance with me."

I find it difficult to take Mr. Luke's argument seriously because who can imagine a more annoying, a more frustrating and a more impractical device than a standardised two-minute gramophone record. For, obviously, if the "full-bass" idea were to be adopted for organ music, it would have to be used also for everything else, to be standard.

Just at the moment, the whole cry is for long-playing records to eliminate the infernal business of jumping up every so often or of waiting resignedly while the auto-changer does its stuff. I'm very much afraid that Mr. Luke is a lone wolf with his special requirements.

Then there's the reference to "low frequencies without distortion." I wonder?

Without bass attenuation, the stylus travel for powerful low notes would be enormous, leading to serious mechanical distress in both the cut-

ter and the pickup. If you've any doubts on this score, just try to play the low frequency grooves on one of the old heavily-cut frequency discs. It fairly makes one weep.

And if the bass were to be restricted enough to prevent this mortal distress, the treble would be left way down in the noise.

But even allowing that these difficulties were overcome, what would constitute the required "level" recording. Would it be the groove cut by some standardised recorder, and, if so, would it be a crystal, a magnetic or some other type? Or perhaps the groove should be "tailored" to give constant output with a standardised pickup? If so, would it be a crystal or magnetic type, for the two differ fundamentally?

CONSTANT WHAT?

Then again, it might be better to decide on a mathematically defined characteristic, but then should it be constant amplitude, constant velocity or constant something else?

The proposition isn't so easy to define after all, when you get down to tintacks.

If the "level" characteristic followed the natural laws of magnetic devices, the crystal people would have to resort to compensation to get the same end result — and vice-versa.

So there it is, Mr. Luke. Since you can't dodge compensation anyway, and since neither constant amplitude nor velocity is alone satisfactory, there is everything to be gained by adopting some standardised recording characteristic which best reconciles all the conflicting factors.

To this point, engineers are in universal agreement, but their "standardised" recording laws are anything but standard. This is the real point of grouch, and it will remain so until commonsense prevails — if it ever does!

But don't run away with the idea that compensation means extra distortion. At the reproducing end, anyway, the reverse is likely to be the case, for de-emphasising the treble and boosting the bass both tend to reduce harmonic distortion.

WOT, NO CURVES?

Have you ever fed a 30-cycle note straight out of a magnetic pickup into the terminals of a CRO. Like as not you will see a triangular wave which is far removed from the graceful sine curve. The distortion is high, admittedly, but that isn't the end of the story.

If the same signal is run through a bass compensating stage, it will emerge vastly improved from the experience. How come?

As first seen on the CRO, the 30-cycle fundamental has been reduced by 6db in relation to its second harmonic on 60 cps and by 9db from its third harmonic on 90 cps. After compensation, the fundamental is boosted to the point where, in effect, the second harmonic has receded by 6db, the third by 8 or 9db, the fourth by 12db, and so on. Any wonder the waveform is improved.

With a crystal pickup, the boost is there all the time, and low frequency waveform generally looks better as a result.

But don't be caught, as I know some have. If you want to compare waveforms from different pickups, make sure they are properly compensated before the point of inspection in the circuit.

SOMETHING WRONG!

I have just completed building the 807 Triode Amplifier as listed in the March issue of R and H for 1948. I am sorry to say that I am far from pleased with the results, specially after reading of the performance which the circuit is said to have given.

This is not my first attempt at building an amplifier and I have had pleasing results from previous designs. However, after spending quite a considerable amount of money on high-grade components and finishing up with the results of a cheap console, I am naturally rather disheartened.

When I completed the amplifier, I connected it to a Rola 12-0 mounted in a vented enclosure. The results were then equal to a standard radiogram but with a little more bass. I then decided to invest in a Goodman's Axiom 150 so I could extend the frequency response. After doing the same and matching to a 15-ohm voice coil, I was more than disappointed.

To obtain the results, I was using a TRF tuner and a Goldring Headmaster pickup. The only thing in its favor was that hum noises were non-existent.

I would appreciate it if you could forward me the name of some radio organisation which would test the amplifier and determine the cause of the trouble.—(J.A.).

But where on earth have I got to? It all started with our correspondent J.A. and the frequent oversight in not providing for bass boost in the amplifier. Let's take up the original theme again.

Broadly speaking, there are four ways of getting out of the bass-boost problem. Let's examine them under numbers and headings.

(1) Use an old-style magnetic pickup or the ever-so-slightly-improved version still fitted to a lot of record changers. Their magnetic circuit is "rigged" to give a general lift at the low end while the treble end is naturally poor by way of further compensation. They've been used from time immemorial, but are not to be taken seriously by quality enthusiasts.

(2) Use a crystal pickup, which will give all the bass response and output you'll ever be likely to want without worrying about compensating stages and such like. (Somebody should tell Mr. Luke about them.) The most modern crystals are mechanically very good, too, their chief limitation being poor output above about eight or nine kc. (Still, that's pretty good!)

(3) Use a lightweight magnetic of a type which comes complete with a compensating "pickup-to-grid" transformer. These are easy on records and sound "nice" in a comfortable, woolly sort of way. You don't have to worry about compensation and preamplifiers, but you won't hear the "spine chilling" highs either!

(4) Use a lightweight magnetic, a lightweight moving coil or a variable reluctance job. This is the hard way, the specialist's way! It's the way you get most off the records, but you simply MUST do the right thing about bass compensation.

JUST DOESN'T WORK

It's a complete waste of time and effort to feed one of these naturally "flat" pickups into a standard flat amplifier and expect the thing to sound right. It simply can't, and it won't.

So it was that, in the April, 1948 issue — the one immediately following the original description — we presented a lengthy article covering compensation requirements and circuitry under the general heading "Using Your New Amplifier."

Had our friend J.A. studied this article, he would either have proceeded to add the extra stage or to buy a crystal pickup which has a natural rise at the bass end and sufficient to compensate for the recording loss.

Therin lay the real basis of the trouble for, by simply installing a magnetic pickup, the reproduction was doomed to be thin and unbalanced, no matter what other steps were taken to improve it.

As it transpired, the next and very costly step could only aggravate the position rather than improve it. This was the installation of an "Axiom 80" loudspeaker.

On the first count, the Rola speaker, in common with all others in the same class, has a definite bass cone resonance in the 70-cycle region which tends to reinforce the low end to some extent.

The Axiom 80, on the other hand, has a free-edge cone and virtually

Don't be surprised if you observe a low frequency waveform like (A) from an uncompensated magnetic pickup. Bass compensation lifts the fundamental in relation to the harmonics and produces something akin to (B).

THE LUCKY PEOPLE WITH PORTABLES

can get outdoors and take their radio enjoyment with them, in the good old summertime. Why not build your own portable — from an Electronic Parts Kit — in time for your holidays and weekends at the beach this spring.

IT'S EASY TO BUILD A PORTABLE

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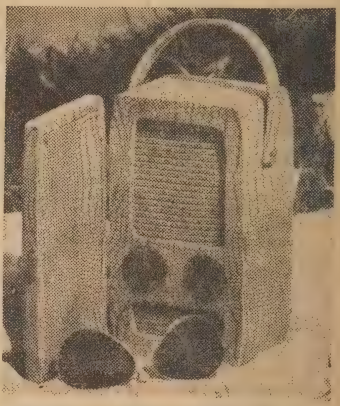
CARRY SET

Smartest of all small portables. A 4-valver, extra simple to build and most efficient in action. Smartly streamlined cabinet makes it a pleasure to carry, and the size is only 8¼" x 4½" wide x 4 deep. Originally described in "Radio and Hobbies", October, 1949.

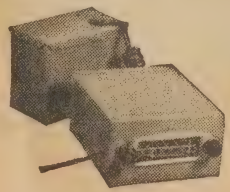


SENIOR PORTABLE

Originally described in "R. & H." for December, 1948, this 5 valve B/C portable with R.F. Stage uses either 6" or 7" speaker. A kit of parts for an A.C. power supply is also available. Cabinet size of portable 12½" x 8¼" x 6½".

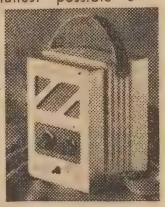
KAR-SET

This is the car radio kit you have been waiting for. Economical to run, and a first-rate performer, it will fit any car, irrespective of size or electrical system.



HANDY-TALKIE

("R. & H." Oct., 1947, and Dec., 1947) The smallest possible 5-valve portable. Ideal for distance getting, combined with compactness. A four-valve version also available in the same cabinet. Size 7" x 4½" x 5".



MULTI TALKIE PORTABLE

("R. & H.," July, Aug., 1948). As its name implies, this is a multi unit portable. It is available as a small 4-valve B/C portable and in addition, an A.C. power unit can be built to enable it to operate from the A.C. mains or a vibrator unit can be built to enable it to operate from a wet battery. Size of portable cabinet 7" x 4½" x 5¼."

no bass resonance in the audible range. If you want bass out of such a speaker, you simply have to feed it in.

Even then, the response is likely to sound a little flat to ears long grown used to the somewhat "coloured" variety obtained from resonant cones.

I can well imagine how pathetic the overall result would now have been.

And just to add a final insult to the injury, the very excellent treble response of the system as a whole would reproduce with maximum efficiency the high distortion content for which most 78 rpm discs are (in) famous. That's precisely why we have had to describe top-cut filter systems to trim off unsavory portions of the register on bad discs and programs.

I can recall at least three occasions since March '48 when these devices have been prominently featured.

Of course, you might reasonably ask whether a private individual can be expected to know these things and to keep track of all these articles?

ANSWER IS—"YES"

Within reason, I think the answer is "Yes"—assuming that he is going to spend as much money on equipment as has our friend J.A. It's one thing to build up a little "pip-squeak" amplifier with inexpensive parts but quite another to start using specialised and expensive wide-range components.

Audio reproduction on that scale becomes very much a science and some knowledge is a pre-requisite for satisfactory results.

I have a few friends and acquaintances very keen on breaking speedboat records and the amount of time and money they spend on this specialised hobby is amazing, to say the least.

But a "prop" to them isn't just a bit of twisted metal. It's a component capable of absorbing a hundred or more horsepower, with a certain pitch and law, blades of specific dimensions, inclined at a certain angle and capable of delivering maximum thrust when just loading the motor to optimum revs.

All in all, it's the most impressive mechanical "output transformer" that I know of.

But how can doctors and businessmen in ordinary life find an answer to such problems? How can they design and hand-make hulls to take the battering of a championship run? Only, I fear, by careful study and a deal of trial and error, by which they ultimately profit.

SO WITH RADIO...

It's pretty much the same with high quality amplifiers or any other kind of specialised radio gear. Unless the enthusiast burns a few pints of midnight oil, he is bound to fall into unnecessary traps.

Fortunately, in this case, our correspondent needs only to add a bass boost stage and more than half of his problems will disappear. If he then adds a top-cut filter ahead of the wide range speaker he should be happy or at least as happy as anyone ever is with this dreaded disease of "ad audiophobia."

And it is, indeed, a disease which seemingly knows no end or cure. The sufferer passes inexorably from one stage to the next, suffering alternate fits of exhilaration and depression. Just at the moment I am in one of the latter.

Fresh from a session with amplifiers, curves, negative feedback and so on, I was handed for comment a couple of 16-inch transcriptions. Complete with flamboyant packets and labels, they had been imported for airing on a local broadcast station.

Expecting to hear something special, I was met instead by a demonstration of rank distortion that could only have come from a very mediocre and much-overloaded recording system.

Having made the appropriate remarks, I was duly informed that companion discs were actually being aired by one of the Sydney stations —and I suppose that Sydney stations on the whole are no better or no worse than any others.

I then suggested, that perhaps the records might sound a bit better when properly equalised, because there certainly wasn't any bass or extreme treble either to boast about.

But equalisation, nothing! The records were simply being played as they came in and no questions asked.

As far as I could discover, the only attempt at equalisation available at any time to the operator or announcer was a two-way switch on the pickup channel for "ordinary" records or transcriptions. The fact that American pressings follow a different law from Australian or British is completely ignored and, if transcription discs happen to differ also, that's just too bad.

Digging a bit deeper, I found that some programs are taken partly off tape or wire, then re-dubbed for convenience or other reasons on to disc. Now the overall response of anything but a full profession magnetic outfit is anything but flat and there would seem to exist in the re-dubbing process an ideal opportunity for complete equalisation, not only of levels, but of frequency response.

NO SUCH CONTROLS

But no! Midst the impressive array of keys and faders, lights and level meters, you'll most likely look in vain for two simple controls—bass and treble compensation.

Now I'm fully aware that the use of compensation facilities calls for discretion and, if not properly set, can produce unfortunate results. And I'm also aware that station engineers don't credit disc jockeys and control operators with much technical or musical appreciation.

I can't speak for the disc jockeys but I do know a few operators at least who are very critical of balance and quality in programs. They must feel pretty bad about it when disc playbacks, wires and tapes come through as ill-sorted and ill-matched as passengers in a railway train.

There are plenty of reasons why all programs and snippets can't be perfect but they can often be improved. If listeners can balance and filter the music in the home to make up an obvious lack, then how much better can the station do it?

Maybe I'm being difficult but that's just the way I'm made.

Just by way of conclusion, here is a question you may like to work out before you read on:

When is the plate dissipation of a class A power stage greatest — when it is idle or when it is handling loud signal?

The question is prompted, of course, by the idea which some listeners have, that they are saving their valves by not turning the volume higher than necessary. Now for the answer!

The plate dissipation in a class A power valve is least and the heating effect lowest when it is delivering maximum power to the loud speaker. You want me to prove the statement? Right!

A single 6V6, under standard 250 volt conditions, absorbs a total plate and screen input of 250 volts times 49.5 milliamps, equals 12.4 watts. Under idle conditions this total wattage is dissipated in the valve as heat.

With a maximum signal, the input rises to 13.5 watts, from which must be subtracted 4.5 watts fed to the load. Only the difference, equal to 9 watts, goes up as heat in the valve. In other words, the valve remains cooler with full power output than with zero output. Q.E.D.

MORE SOBRIETY GENTLEMEN!

Dear Sir,

I have been a reader of Radio and Hobbies for many years and, considering that you cater for mainly radio hobbyists, I feel that it has many excellent attributes.

However, of recent months I have been annoyed, indeed pained, to observe an increasing amount of facetious material appearing therein. Articles which have hitherto been treated in a sensible, sober and completely objective manner, I now find contain such ridiculous allusions as the one in a recent issue, regarding a woman's hearing being more sensitive than a man's.

Why, I ask is it necessary to try (please note I say "try," as there is apparently some effort required) to be funny in an article on technical radio? If I had ever wanted to laugh, I would have spent my 1/- on another kind of magazine . . . I find your articles describing amplifiers and sundry pieces of equipment quite informative and, up to date, have been willing to overlook Calvin Walters' lapse into the ridiculous, but I do object to having my mind distracted by these puny and futile efforts to be funny. Abbott and Costello do a much better job and without a knowledge of radio.

The latest effort, and that which prompted this exposition is the recent series under the title of "Let's Buy An Argument." As if life isn't complicated enough, without making it more so.

In this series, you have an excellent opportunity to bring forward some controversial aspects of radio and of discussing them with the dignified and learned among your readers. But what do you do? As I see it, you merely give a poor imitation of Willie Fennell at his worst. (W.H.H., Pennant Hills, NSW.)

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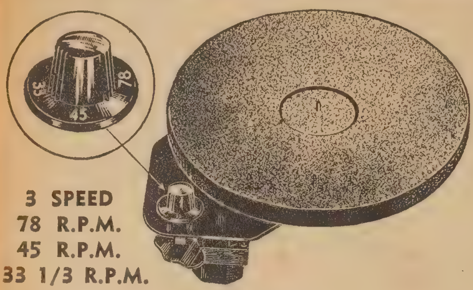

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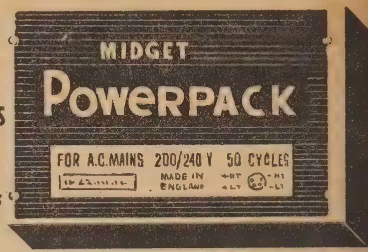

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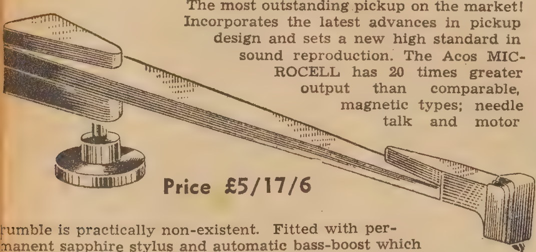

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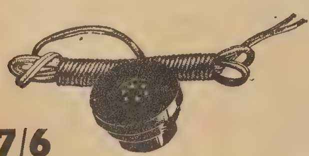

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WHICH RECORD SPEED IS BEST?

Whether they like it or not, the American public has been landed with a certain three and a possible four distinct record speeds. But what does the future hold for enthusiasts in England—and in Australia? This is a vexed question. The following article, reproduced by courtesy of Wireless World examines the whole situation and, incidentally, makes a good case for 45 rpm as a universal speed—whether for L.P. or single-number discs.

By G. F. DUTTON*, PhD, DIC, AMIEE

THE history of the disc gramophone shows that there has been a great variety of turntable speeds and of groove dimensions. The early discs were of about 7in to 8in in diameter and it will be shown later that the turntable speed of about 78-rpm was justified at that time.

The groove dimensions and amplitude of cut were dictated by the need for direct mechanical reproduction through a horn system. The development of the more delicate electrical pickup mechanisms has naturally changed these requirements, but mechanical gramophones are still used by many people throughout the world.

UNIVERSAL APPEAL

A very important aspect of the gramophone record was its universality. Except for slight variations of frequency characteristics a record made in this country could be played wherever there was a pickup or a portable gramophone.

The introduction into the commercial market of the microgroove and at least two alternative speeds robs the disc of its universal application.

It has been stated on good authority that the sales of the standard 78-rpm records throughout the world, 40 to 50 pc go to customers who have the portable mechanical type of machine only. It is also interesting to note that though the number of portable mechanical gramophones exported from this country greatly exceeds the home consumption, the latter has shown a distinct rise since the end of the war.

The USA, being a highly electrified country, has no mechanical gramophone problem. It is to be expected, therefore, that a firm in the USA can embark on new standards of speed and groove dimensions with less embarrassment than firms in this country.

78 RPM WILL CONTINUE

It must be clear, therefore, that whatever alternative speeds and groove dimensions are eventually adopted, the standard 78-rpm record must continue for a considerable time.

We should perhaps at this stage state the specification for the performance of a gramophone disc. There is no doubt, however, that it will be the public who will finally choose the specification, but we may usefully list what we think to be the items which could be discussed here on technical grounds.

Before we do that we should bear in mind that the buying public can, I suggest, be roughly divided into two age groups—14 to 30 and 50 to 70.

The first group, 14 to 30, is the romantic group, requiring dance music, hot jazz, crooning, &c., with a fair demand for the more serious classical music. They have little money to spend and probably prefer to spend only a little at a time.

The second age group, 50 to 70, is the connoisseur group with more money to spend and more time to listen to long operatic works. One age group would tend to sway the gramophone industry to concentrate on short five-minute records and the other to adopt long-playing records.

The use of long-playing records to string together whole series of dance tunes would, I think, be ridiculous. It is difficult enough, with the 10in, 78-rpm record, to choose suitable coupling items for the two sides of the disc. I must also mention that there are many lengthy classical works covering, say, a dozen 12in discs, and the sales of one or two discs from the set

Fig. 1. (Right) For a given minimum groove speed there is an optimum turntable speed for maximum playing time with any given outside diameter of record. This group of curves tells the story.

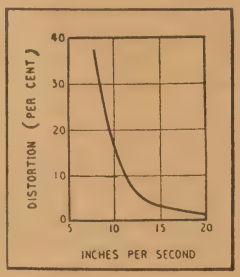

Fig. 4. (Above) For a given stylus radius and lateral velocity of cut, distortion is inversely proportional to the fourth power of the tangential (linear) groove speed.

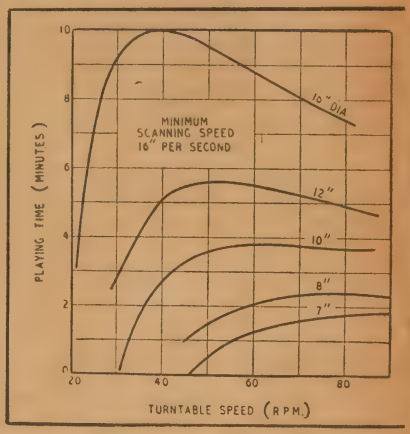

Fig. 2. (Below) Principal groove dimensions in microgroove recording. Compare this with the composite drawing of figure 10.

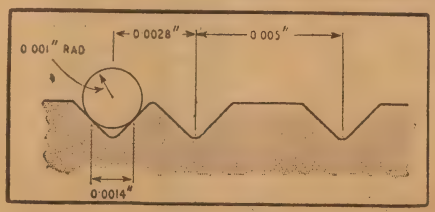

Fig. 3. (Left) Using the groove of Fig. 2, the theoretical minimum spacing without modulation is 0.0028in (about 350 grooves per inch). In practice an average of 250 gpi is rarely exceeded.

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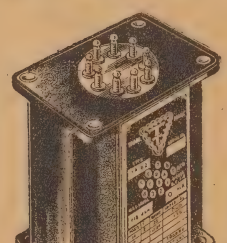

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PLAYING TIME RELATED TO PHYSICAL DIMENSIONS

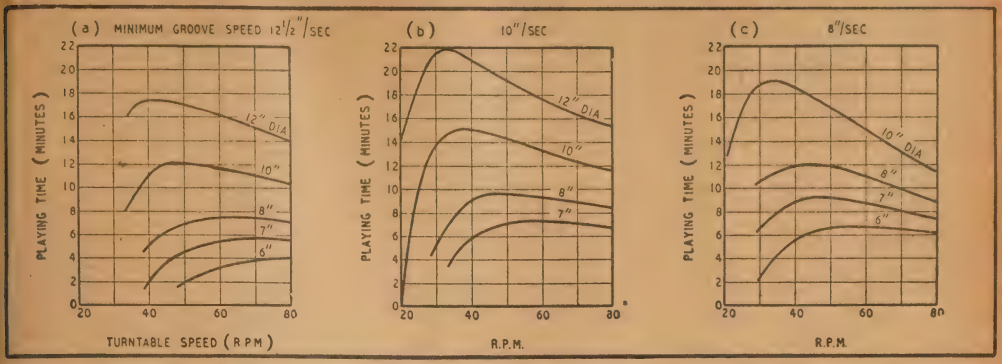

Fig. 5. Playing time, for 250 grooves per inch, in terms of minimum groove speed, external diameter of disc and turntable speed.

far exceeds the sale of the complete work.

It would seem, therefore, that the record of short duration, say, up to five minutes, is a definite requirement. Does the standard 78-rpm record fulfil the requirements of a short-duration record?

To a large extent it certainly does, but we must consider whether the size of the record player, the storage of records, the economical use of low-surface noise and high-grade moulding material are items which would swing the development towards small diameter lower-speed discs.

Shellac is an ideal resin for moulding, since it flows freely at a moderate moulding temperature and pressure. Its great drawback is its dimensional instability without the use of a large percentage of mineral filler. This filler is the cause of most of the so-called surface noise.

The record, however, stands up well to the variable treatment that it may experience by reason of the great variety of needles and pickup playing pressures used throughout the world.

The unfilled vinyl co-polymer resins can only be used with safety by the modern lightweight pickup with precision needle points.

The plastic is expensive, and, like most high molecular weight resins, requires high moulding temperatures and pressures. This in its turn is liable to cause strain which may lead to warping. When using vinyl plastic, therefore, the small disc is to be preferred.

LONG-PLAYING 78's

Can long playing be fulfilled by the 78-rpm standard disc? History shows that there have been many attempts and some quite successful.

For instance, the World Record Company in 1910 brought out a disc claiming to play from 10 to 100 minutes employing a constant groove speed. A sample record is extant which plays for 12 minutes, the turntable speed varying from 30 rpm on the outside to 80 rpm on the inside.

The use of constant groove speed is the most efficient way of operating a disc, since the quality can be kept constant at a pre-determined value. The mechanism to produce this constant groove speed and at the same time avoid "wow" and "flutter" is something of a mechanical problem.

The 33 1-3 rpm speed was introduced for 16in discs to be used in conjunction with films. With these large-diameter discs 33 1-3 rpm is justified. In recent years it has been used by broadcasting concerns, both for processed transcription records and for lacquer recordings. The groove dimensions are the same as for 78-rpm standard.

The 16in disc is, of course, too large for domestic use.

If we examine Fig. 1 we see a family of curves showing the relation between playing time and disc speed for various overall diameters. The minimum groove speed is

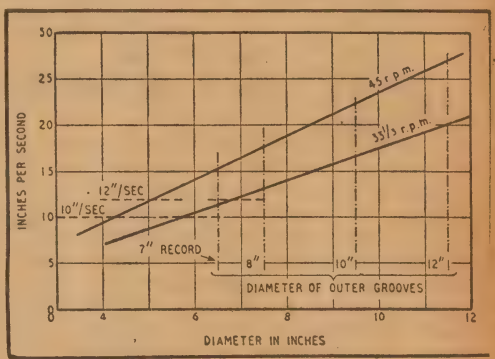

Fig. 6. Relationship between linear groove speed and groove diameter.

16in/sec and there are 100 grooves per inch.

The playing time of a record is determined by the width of the recorded area on the record, the spacing between individual grooves, and the angular speed of the turntable.

The average groove spacing depends very largely on groove width, which in turn is controlled by the size of the needle point, and to a slightly lesser degree on the amplitude of the recording cut.

The turntable speed and the total width of recording allowed are related together by considerations which involve the overall diameter of the record and the least permissible tangential groove speed; the latter depends in turn on the same two quantities, that is to say the needle size and amplitude of cut which are involved in groove spacing. Since these two features control playing time in two distinct ways they merit the first consideration.

For use on microgroove records, the radius of the hemispherical tip of the needle has been reduced from the value of 0.0025in, associated with standard records, to 0.001in.

To avoid excessive wear or major damage to either the needle or the record, it has been necessary to reduce the needle pressure and stiffness by at least the square of this ratio.

This has been achieved partly by reducing the mass of the pickup head and partly by some degree of counterbalancing: further reduction of needle pressure would almost inevitably have to be achieved by increased counterbalancing alone.

If the radius of the needle point were reduced below the new figure of 0.001in,

(a) the uniformity of performance between needles would deteriorate seriously,
(b) the needle tip would be too susceptible to accidental damage,
(c) the counterbalancing would become critical and would involve individual adjustment,
(d) the ratio of the residual moment to the moment of inertia would be so low that the needle might fail to maintain proper contact with record which are slightly warped.

In all proposed microgroove re

cut has been reduced in, at least, the ratio of the needle-tip reduction, at the lower frequencies, which determine the greatest amplitude.

Further decrease would not give a proportionate increase in playing time, particularly if the groove pitch is made variable. On the other hand, with pre-emphasis the amplitude of cut at high frequencies is only slightly below the standard (78-rpm) records.

Fig. 2 shows the dimensions of cross-section of the groove. The best position for the needle to engage the groove wall is half-way up the wall where there is the least danger of distortion of the wall by rounding.

It will be clear from Fig. 3 that the width of the needle at the point of engagement is 0.0014in and that the absolute minimum groove spacing, is consequence, 0.0028in.

In extremely quiet passages, a record could theoretically be cut to 350 grooves to the inch, but in practice an extra tolerance has to be allowed to ensure that grooves do not cut into one another. An allowance for this effect leads to a groove-to-groove spacing of 0.0035in, and a maximum of 280 grooves per inch in silent and fairly quiet passages.

AVERAGE PITCH

Heavy recording will require an increase of spacing of at least 0.0015-in, making 0.005in in all, but, as loud passages do not in general predominate, it is thought that variable groove-pitch system would allow an average of 250 grooves per inch. All the following calculations of playing time are made on this assumption.

The distortions which arise in following a groove in detail by Pierce and Hunt, Lewis and Hunt, and others. Briefly, the expression for distortion contains terms of the form:

$$\frac{r^3 V^3}{S^4}$$

where r is the needle-tip radius, V is the lateral cut velocity, and S is the tangential velocity. This means that, in order to produce similar distortion conditions S squared varies directly with rV.

In considering harmonic distortion of lower frequencies, or inter-modulation between high notes, however, involve values of V which are unchanged from the standard record, and here a reduction of S in the ratio of the square root of 2.5 or only about 1.6, is justified.

Taking into account the importance of the various types of distortion, it is probable that the permissible decrease of tangential velocity, from that of the standard record, is in the ratio of 2 to 1.

Fig. 7. (Right) Groove speed as a function of time, with zero time at the centre of the record.

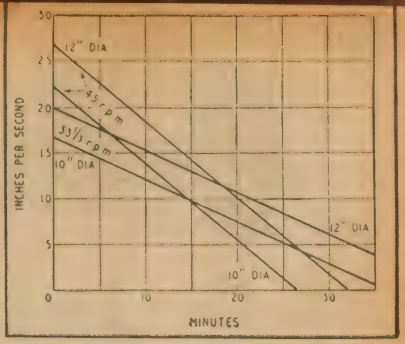

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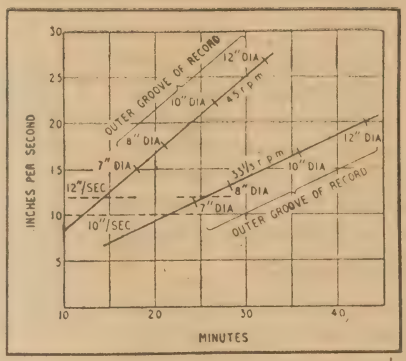
Fig. 8. (Below) Data for 10in and 12in discs re-plotted from Fig. 7 with zero time at start of outer groove.

☆



Existing standard 78-rpm records in extreme cases play to a tangential velocity as low as 16 inches per second, and distortion is apparent at the inner grooves, if the amplitude of cut is high. In fact the quality in loud passages is not noticeably impaired at 22 inches per second.

On this basis we should recommend that microgroove records should preferably be terminated at 12 inches per second, and certainly never allowed to play beyond 10 inches per second.

Experience has shown that the distortion which sets in at a certain point in the playing of the record, increases at a rate which appears to be out of all proportion to the change of radius. It cannot be too strongly emphasised that this is completely justified in theory by its dependence on the reciprocal of the fourth power of the speed.

Similarly, we are quite justified in drawing a strong distinction between speeds differing as little as 12in and 10in per second, because this small difference accounts for more than a two-fold increase of distortion. This is illustrated in Fig. 4.

On the assumption of an average of 250 grooves per inch, the playing time can be calculated for various sizes of the record, minimum groove velocities, and turntable speeds.

From Fig. 5 it will be seen that for each record size and minimum groove velocity there is actually an optimum turntable speed; at this speed the outermost groove is played at twice the minimum groove velocity, and the music occupies just one-half of the radius of the record.

45 V. 33 RPM

The curve of playing time plotted against turntable speed is, however, very flat near its maximum and change of speed by 20 pc in either direction from the optimum only results in reducing the playing time by 4 pc from the maximum. For this reason, it is only necessary to consider the two figures of 33 1-3 rpm and 45 rpm which have already been adopted: if the optimum for any given set of conditions falls centrally between these two, no great loss can arise from adopting either.

It is obvious that linear speed which has a marked effect on quality, is greater at the starting groove of a record turning at 45 rpm than on one of the same diameter turning at 33 1-3 rpm, but equally clear that, as the needle moves into the centre more rapidly in the faster

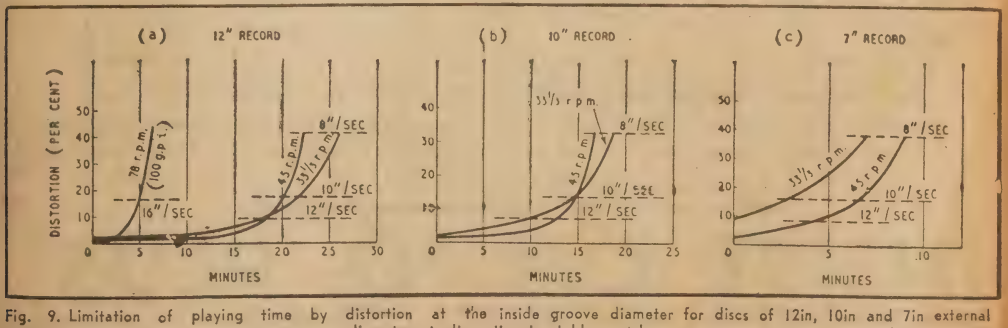


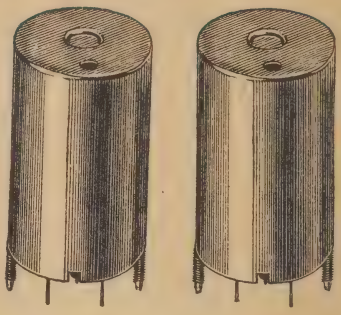
Fig. 9. Limitation of playing time by distortion at the inside groove diameter for discs of 12in, 10in and 7in external diameter at alternative turntable speeds.

Both Alike

but such a difference

Here at "Q Plus" Laboratories we have recently been conducting tests between various other coils I.F.'s, etc., obtained from manufacturers' distributors overseas, etc., to prove that we at "Q Plus" were offering you "Pound for Pound" value in your purchases. Many coils look alike but those extra stations from distant parts come FREE to the more sensitive coils.

Compare these results for yourself! And in later ads. other results will be published.



FEATURES	Q-PLUS A.C.5.	Q-PLUS A.C.4.	COIL 1	COIL 2	COIL 3
PERMEABILITY TUNED	YES	YES	YES	YES	YES
"Q" of sec. at 500 Kcs	176	110	110	110	124
Coil Gain at 600 Kcs	9.75	6.5	5	6.5	7.00
Coil Gain at 1500 Kcs	13.5	11.00	4.5	4.5	5.00
Spheroclad Construction	YES	NO	NO	NO	NO
Coupling "K"	Optimum	Optimum	Under	Under	Optimum

These results were checked with a Marconi Circuit Magnification Meter and a specially designed test chassis for gain test and the results are vouched for by the manufacturers R. W. Steane & Co. Pty. Ltd.

INSIST ON "Q. PLUS"

record, the linear speed falls off more rapidly.

Actually, there is a time at which the two records, started at the same instant, will be moving at the same linear groove speed and therefore give the better quality.

This critical point occurs at about 15 and 18 minutes from the start on 10in and 12in records, respectively, and occurs at linear speeds of about 9½ and 11½in per second.

In Fig. 6 the variation of groove velocity is plotted against the diameter of the groove which is being played. The diameter of the inner groove is given by the intersection of the appropriate line with the limiting groove velocity chosen: from

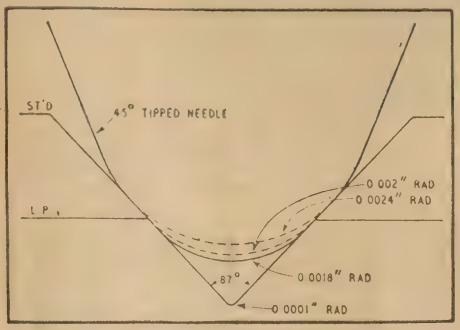


Fig. 10. Standard and microgroove sections superimposed with needle tips of different radii.

this the useful area of the record can be deduced.

In Fig. 7, the tangential speed is plotted against time, and as a matter of convenience, zero is the time when the needle reaches the axis of the record.

To compare the performance at the two speeds for a particular outer groove diameter, the curves are shifted laterally to align the points corresponding to the outer groove diameters, and the zero is shifted to this actual starting point. The pairs of lines corresponding to 12in and 10in records resulting from this operation are shown in Fig. 8, and indicate the critical points already mentioned.

SUMMARISING

Graphs of this kind have been used, in conjunction with the inverse fourth power conversion, to calculate the curves of distortion for various record diameters shown in Fig. 9. In each case, the starting groove is taken as having a diameter half an inch less than the nominal outside diameter of the record.

Summarising, it can be stated that:—

(a) 12in records can be played at either 33 1-3 or 45 rpm with good quality to 18 minutes. At 45 rpm the 10 inches per second limit is reached at just over 20 minutes: at 33 1-3 rpm this limit is extended nearly to 22 minutes. The rise of distortion is illustrated in Fig. 9 (a).

(b) 10in records can, in the extreme, be played to 14½ minutes at either speed, but the last four minutes of playing will have noticeably better quality on the 45 rpm record. The lower distortion in the latter case is indicated in Fig. 9 (b).

(c) For smaller records, the higher turntable speed is unquestionably better: by this means popular five-minute recordings can be made comfortably on 7in discs. The advantage is clearly shown in Fig. 9 (c).

In deducing the minimum groove velocity we have tacitly assumed that the techniques of recording and processing have kept pace with the reduction of needle size. Results already achieved show that this is in fact possible, but the process requires an increase in skill and supervision, and adds considerably to the production difficulties.

If the choice of turntable speeds were completely free, it would still be difficult to arrive at a definite optimum, because the relative commercial importance of short and long recordings exerts so much control on the choice.

It is impracticable to use the optimum speed where the record is smaller than 8in, because this, after allowing for a run-off groove, would leave an inadequate table diameter. For an 8in record, the optimum varies from 60 rpm to 50 rpm, according to the quality permitted.

The higher speed should be deprecated, however, partly because it allows no margin for squeezing a little more on to a record (which is quite justifiable where the record ends with a quiet passage), and partly because it is very uneconomical for 12in records. The highest speed that should be considered is therefore 50 rpm.

At the other end of the scale, the optimum for 12in records varies from 40 rpm to 33 1-3 rpm, according to quality, but the loss due to using 40 rpm is, in any case, small.

The range of choice therefore lies between 40 rpm and 50 rpm. It should be biased to one end or the other of this range according to the relative importance of large and small records respectively.

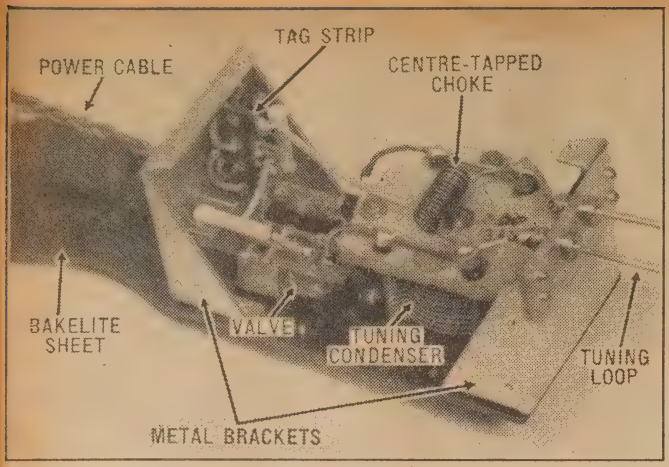
USE OF UNIVERSAL NEEDLES

In this report no account has been taken of the American proposals for truncated or other universal needles, although we appreciate the practical convenience of such a needle.

Most recording companies are now cutting the 78 rpm type of record with a radius at the bottom of the groove of 0.001in, but it must be remembered that there are a large number of records in circulation which have a bottom radius of at least 0.002in.

A universal needle will not necessarily ride on the straight walls of a groove unless the width at the points of engagement is less than 0.0024in (for microgroove records) and simultaneously greater than 0.0028in (for the older 78 rpm records). It follows that, in one case or other, the needles will ride on surfaces which are not accurately

(Continued on Page 73)



With the cover removed, all parts are visible. Note the polystyrene block which mounts the jacks for the loop.

A GRID-DIP METER FOR VHF

Covering the range from 80 Mc to 160 Mc, this new extension to the Radio and Hobbies Grid-Dip Oscillator makes the 144 Mc band just as easy as 50 Mc. It may be built as an instrument complete in itself or may use the meter and batteries of the basic unit described in the April 1950 issue. It eliminates the old "guess and hope" method of designing tuned circuits and no serious VHF experimenter should be without one. A particularly neat circuit simplifies the making of the tuning inductors.

by Maurice Findlay

THE new unit will perform all the functions of its low frequency counterpart. In addition to its primary job of determining the resonant frequency of tuned circuits, it can be used as to monitor the output of a transmitter on phone, MCW and CW, as an absorption type frequency meter, standing wave indicator and for a dozen other uses which will suggest themselves.

Used in conjunction, the VHF unit and the basic unit provide complete coverage between 450 Kc and 160 Mc and we are certain that you will find no other instrument in your workshop as freely useful.

USEFUL INSTRUMENT

However, there is no need for us to try to "sell" our readers on the idea of grid-dip oscillators. The interest shown in the articles in the April, 1950, and March, 1951, issues is sufficient proof of their worth.

With the basic instrument, an important consideration is that it use parts available readily from any radio supply house. Special VHF valve types and "butterfly" type tuning condensers were definitely ruled out since most of these items available to experimenters originally came from military disposals sources. The few that are available through normal channels are imported from overseas and their cost is by no means a small item.

Consequently, our original instrument made use of a standard miniature battery valve and a small tuning condenser which is readily available. The upper frequency limit is 80 Mc approx. if a useful amount of grid current is to be obtained.

A meter to operate above this frequency requires a more specialised approach. The standard valve has to be replaced by a valve with interelectrode capacitance reduced to a minimum, low transit time, and small lead inductance. It is no longer easy either to make an efficient tuned circuit with a simple single stator tuning capacitor, remembering that the tuned circuit must incorporate a means of providing feedback.

A tuned circuit consists of an inductive element and a capacitive element. Energy can be fed back into it either by tapping into the inductive element or by dividing the capacitive element. In general, the former type are known as Hartley oscillators and the later as Colpitts oscillators.

The grid-dip oscillator makes use of inductive coupling so that the inductive element must take such a physical form that it can be coupled easily to other tuned circuits of all shapes and sizes. At the frequencies under consideration, a single loop of wire appears to be the most convenient form.

FEEDBACK METHODS

It is then more convenient to obtain the feedback by capacitive means. Inductive feedback is inefficient since the long lead from the centre of the tuning inductance, which is in series with the feedback circuit, in itself possesses appreciable inductance. Apart from this, the interelectrode capacitances of the valve provide a certain amount of capacitive division which could easily counter the inductive division and again reduce the strength of oscillation.

By employing a tuning capacitor with two sets of stator plates, capacitive division of the tuned circuit can be obtained quite simply. There only remains the problem of feeding the direct current to the plate of the valve. The usual way is to wire a choke from the high-tension supply of the plate of the valve or, better still, to the centre of the inductance, where the RF potential is low. This arrangement does not eliminate the long lead to the centre of the loop but its length is no longer very important.

Although this arrangement overcomes the efficiency problem, it still requires three connections to the loop. This is a serious disadvantage when it is desired to have the loops readily changeable and at the same time easy to fabricate.

OUR SOLUTION

A neat and simple solution to the problem is incorporated in our final design. It simply involves wiring a small inductor in parallel with the loop, inside the instrument. The inductor has a high value compared with the inductance of the loop and the resultant inductance is virtually that of the loop alone.

But there is this important difference. It is now possible to feed direct current into the loop without reducing its efficiency appreciably,

and, further, the loop is reduced to a two-terminal device, which can be interchanged quite easily if it is desired to cover different ranges.

Quite frankly, it is not possible as far as we know to walk into a radio store and buy a valve that is suitable for the VHF instrument. The valve must be a filament type triode or a triode-connected pentode designed specially to operate at high frequencies. If you wish to extend the coverage to as high a range as possible we would recommend the 958 which is an acorn type and similar to the 955 except for the filament. By carefully placing its socket to obtain short leads, it should be possible to maintain a worthwhile amount of grid current to a frequency of over 200 Mc with this valve.

THE VALVE

Next on the list, we would recommend the 957 which is similar to the 958 except for its power ratings. Of course, if you are stuck for a valve, you can always revert to the old, reliable 955. It will probably work better than any of the battery valves but requires a filament supply of 6V at 150 mA. This could be obtained either from a small filament transformer or from a set of four dry cells. Ordinary large-size torch cells could be used, since the instrument is not likely to be in operation for extended periods.

Whether the instrument should be operated from batteries or from the power mains is a subject for debate but we must admit to a bias in favor of battery operation because of portability which it allows. The cost of the batteries compares very favorably with that of a small power supply and, since the instrument is only used for short periods, they will last almost their shelf life.

MAINS OPERATION

If you feel that you would be better served by a mains-operated instrument, there are not likely to be any problems in designing a small power supply to deliver an AC filament supply and about 100V filtered DC for the high tension.

We happened to have on hand a small battery triode which originally came from an emergency "lifeboat" transmitter. Electrically, it appears to be along the same general lines as the 958. However, it has no special base, being intended to be soldered directly into the circuit. The leads are fairly thin and we took the precaution of making up a special bracket from a piece of polystyrene to mount the valve and provide anchor points for the leads. As a result, the leads were not as short as would have been physically possible. However, there is still plenty of grid current at 160 Mc, giving a neat overlap of the 144 to 148 Mc amateur band.

The tuning condenser in our unit came originally from an English VHF transmitter/receiver and has a capacitance of approx. 60 pf between each stator section and the rotor. It was intended to operate with a special automatic tuning mechanism and was not provided with the usual ¼in diameter spindle. However, by exercising a little ingenuity we were able to make up the deficiency. A check with the various disposals dealers will probably bring to light several other condenser types which would be suitable even if you found it necessary to vary the mechanical arrangement we have adopted.

It is possible to buy suitable condensers from the regular supply houses although the cost is not inconsiderable. If you find it necessary to buy a new condenser choose one of the type which allows 180 degrees rotation, as the usual butterfly type allows only 90 degrees rotation and the tuning tends to be more critical.

Different tuning condensers will probably require a modification to the layout but this will be well within the capabilities of readers interested in an instrument of this type. It would have been possible to have made our instrument slightly smaller but, for ease of construction, we made the dimensions a little on the generous side.

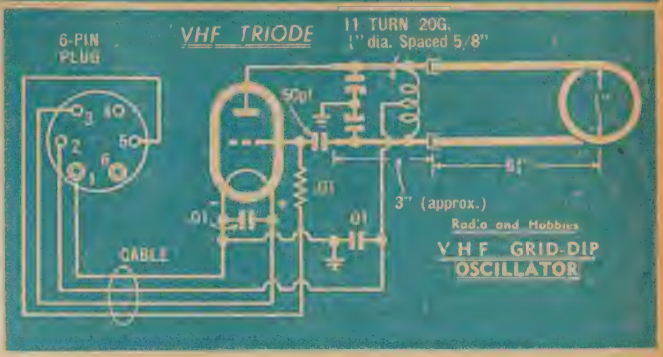
CONSTRUCTION

The bakelite panel, including the handle, was made from a piece of bakelite 8in x 2¼in x 1-8in. Two metal brackets, each measuring 1-8in x 2 1-8in, are mounted, 4½in apart, on the bakelite panel, and the metal body of the instrument is completed by a U-shaped metal cover.

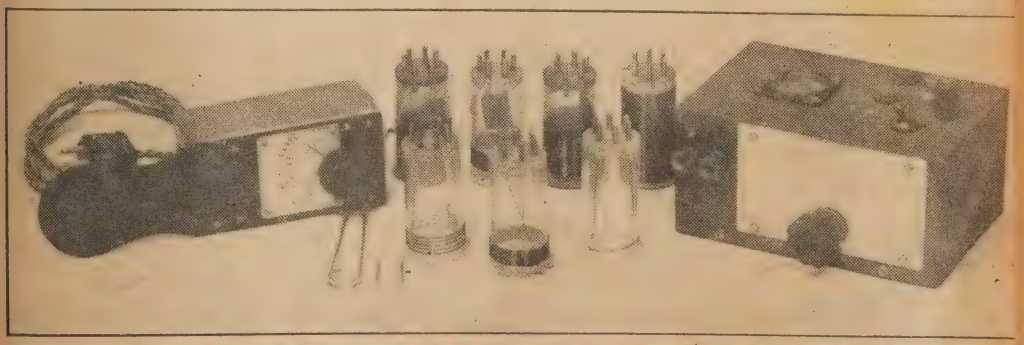
The metal bracket nearest the handle is used as a support for the valve and the tag strip and the power cable is brought through a rubber grommet.

On the other bracket is mounted a block of polystyrene which is used to support and insulate the loop. It measures 1¾in x ¾in x 1-8in thick

VHF UNIT HAS NOVEL CIRCUIT



The above circuit shows the new unit wired to make use of the batteries and meter of the basic unit, the circuit of which is published on page 51. A tuning condenser with a capacitance of about 60 pf per section is suitable. Valve types are discussed in the text.



The complete instrument has quite an impressive array of components. It will eventually be housed in a special box divided into the appropriate compartments.

TOYS FOR BOYS OF ALL AGES

HORNBY

All Hornby Train Sets are supplied with locomotive, carriages or trucks and a basic track The mechanical types are ready for immediate use. Transformers are not supplied with the electric sets, but must be purchased separately.

DUBLO ELECTRIC

Miniature Electric Semi-scale models.

EDG7. Tank Goods Set	£11/6/-
EDP1. Streamlined Passenger "Sir Nigel Gresley"	£12/17/6
EDP2. Passenger Set "Duchess of Atholl"	£14/0/-
The above sets include speed and reverse controller	
EDL7. Tank Locomotive	£3/17/6
EDL1. Streamlined Loco	£4/12/6
EDL2. Locomotive LMS.	£4/17/6
No. 1 Transformer	£3/5/-
No. 1 Controller	£3/7/6

ROLLING STOCK

D1. Tender. LNER	13/3
D2. Tender. LMS.	15/6
D1. Corridor Coach	13/3
D3. Corridor Coach	£1/2/-
D1. Cattle Truck	7/-
D1. Coal Waggon	7/-
D2. Coal Waggon	7/9
D1. Fish Van	7/-
D1. Goods Van	7/-
D1. Goods Brake Van	9/9
D1. High Capacity Waggon	11/9
D2. High Sided Waggon	7/-
D1. Horse Box	7/-
D1. Meat Van	7/-
D1. Oil Tank Waggon	8/9
D1. Open Waggon	6/3
D1. Petrol Tank Waggon	8/9

ACCESSORIES & ILS

D1. Buffer Stops	2/3
D1. Foot Bridge	15/6
D1. Island Platform	£1/2/6
D1. Loading Gauge	3/6
D1. Through Station	£2/14/-
D1. Water Crane	4/-
D1. Signal. Single Arm	2/9
D1. Signal. Double Arm	3/3
D1. Signal Cabin	17/-
EDB1. Straight Rails	4/9
EDB½. Straight Half Rails	3/6
EDB¼ Straight Quarter Rails	3/-
EDBS. Short Rails	2/6
EDBT1. Terminal Rails	11/3
EDA1. Curved Rails	4/9
EDA½ Curved Half Rails	3/6
EDPR/L Points. Per pair	£1/12/-
IBR. Isolation Rail & Switch	9/6
UBR. Uncoupling Rail	8/-

MECCANO SETS, ETC.

No. 0. Complete Outfits	11/-
No. 1. " "	18/-
No. 2. " "	£1/4/-
No. 3. " "	£1/15/-
No. 4. " "	£2/10/-
No. 5. " "	£3/10/-
No. 6. " "	£4/7/6
No. 7. " "	£6/10/-
No. 0A. Accessory Outfits	7/-
No. 1A. " "	7/-
No. 2A. " "	13/-
No. 3A. " "	17/-
No. 4A. " "	£1/4/-
No. 5A. " "	17/6
No. 6A. " "	£2/2/6
Gears Outfits "A".	18/-
Magic Motor (Clockwork)	9/6
Clockwork No. 1. Motor	£1/4/-
Electric 20 volt Motor	£2/14/-
Transformer. 20 volts	£3/17/6
No. 1. Dinky Builder	19/-
No. 2. Dinky Builder	£1/17/6
No. 1A. (Use with No. 1.)	19/-

O GAUGE CLOCKWORK

All models reverse except MO.

M0. Goods Set	£1/16/-
M0. Passenger Set	£1/16/-
M1. Goods Set	£2/15/-
M1. Passenger Set	£2/15/-
201. Tank Goods Set	£4/2/-
101. Tank Passenger Set	£4/8/-
501. Passenger Set	£5/10/-
601. Goods Set	£5/10/-
M0. Locomotive	17/9
M1. Locomotive	£1/9/9
101/201 Locomotive	£2/4/-
501/601. Locomotive	£2/19/-

O GAUGE ELECTRIC

E501. Electric Passenger Set	£7/15/-
E601. Electric Goods Set	£7/15/-
T20. Transformer for above	£3/17/6

ROLLING STOCK

Tenders for M0.	2/6
Tenders for M1.	3/3
Tenders for 501	5/9
Cattle Truck, No. 1	9/9
Cement Truck	7/3
Coach, No. 1	7/9
Crane Truck, No. 1	11/6
Flat Truck	5/9
Flat Truck with Drum	7/9
Flat Truck with Container	8/3
Gas Cylinder Waggon	5/9
Goods Van, No. 1	9/9
Goods Brake Van	11/9
Hopper Waggon	10/3
Lumber Waggon, No. 1	6/3
Milk Traffic Van, No. 1	11/6
Passenger Brake Van	7/9
Petrol Tank Waggon, No. 1	6/6
Refrigerator Van, No. 1	9/9
Rotary Tip Waggon, No. 1	7/3
Side Tipping Waggon, No.1	7/3
Timber Waggon, No. 1	4/9

ACCESSORIES

Buffer Stops, No. 1	4/-
Footbridge, No. 1	14/-
Level Crossing, No. 1	12/9
Platform, Goods, No. 1	18/6
Platform, Island	£1/1/-
Platform Crane	12/-
Posters. Pkt. of 12	9d
Signals No. 2	8/-
Signals, D.A., No. 2	10/3
Signal Cabin, No. 2	10/6
Station, No. 3	£1/4/-
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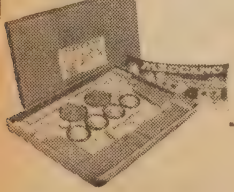

PRICE'S RADIO

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The loop plugs into two metal jacks which are drilled to give a neat fit and hold it firmly in place.

If you use jacks with the holes drilled right through it will be necessary to mark the loop to show how far it is to be pushed in, otherwise make sure that the loop is pushed in as far as it will go, both when the instrument is being calibrated and in subsequent use. The jacks are mounted ½in apart to correspond with the loop.

ALTERNATIVE COMPONENTS

Most of the time taken in building the unit will go into mechanical work as the wiring is particularly simple. There are one or two points to be carefully noted, however, in the interests of efficiency. Remember that the wires inside the case connecting the loop jacks to the tuning condenser and thence to the valve are just as much part of the lecher system as the detachable loop itself and should be kept to a minimum length and as symmetrical as possible.

If, because of different components, your leads happen to be different from those in the original it will be necessary to modify the length of the loop to suit. It may be a good idea to start with a loop a little longer than that specified and then trim it to cover the desired range. The shunt choke should be soldered across the lechers at close as possible to the jacks to reduce the shunting effect as much as possible.

An important lead is that between the rotor of the tuning condenser and the filament of the valve. This lead is acually in series with the feedback path and therefore should be as short and direct as possible. The two bypass condensers are also important and should be mounted with short leads. The bypass across the filament helps to increase the strength of oscillations by reducing the effect of filament inductance while the high tension bypass prevents RF energy getting into the power cable and causing random hand-capacity effects.

CABLE CONNECTIONS

Naturally, our VHF unit was wired to be used in conjunction with the basic low frequency unit and for this reason has a 6 pin plug to match the 6 pin coil socket on the basic unit. If you check with the circuit published on this page you will note how this is arranged. The filament switch on the basic unit may be in the "off" position, and the VHF unit will come into operation automatically when it is plugged in. But be careful to remove the plug as soon as you have finished a check, otherwise you will waste the batteries.

Most readers will wish to follow a similar arrangement but there is no reason why you could not make the VHF unit complete with its own batteries and meter. Or if you wish to save the expense of a meter you could arrange a couple of jacks to plug into the bench multimeter.

Practically any small meter of reasonable sensitivity may be used. The meter in our instrument has a full scale deflection of 2 mA and with the .01 meg. grid leak specified gives about half scale deflection throughout the range. With a O-I mA meter you could possibly increase the grid leak to .015 meg.

Calibration of the instrument is best effected with the aid of a signal generator. If it covers up to 100 Mc or more so much the better. Signal generators covering up to 30 Mc or so could possibly be used but the harmonic output is not likely to be strong enough to give an audible beat note and even if the beats are audible their large number is likely to be confusing. We used the 7-band oscillator described in the June issue, which does cover to 100 Mc.

The proceedure adopted with the original instrument was to hold the loop near an output lead of the signal generator with the generator switched to full output. The beat note can be heard in a pair of phones in series with the grid circuit. As you can imagine it is fairly difficult to hold a steady beat note at frequencies in the order of 160 Mc with such a simple oscillator but you should be able to get indication of the calibration point. The signal generator dial will probably be fitted with a vernier so that it may be easier to use this to find the beat note.

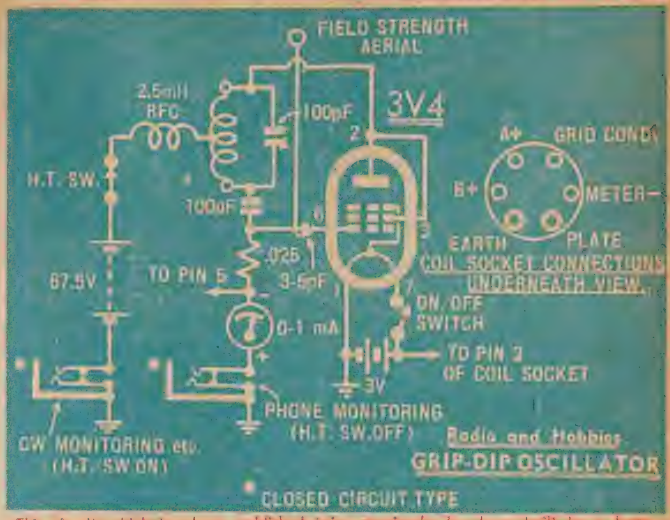
CALIBRATION

As we mentioned earlier the loop specified covers the range from 80 Mc to 160 Mc with a small overlap at each end of the band. The 144 Mc band is towards the end of the scale and because of the quadrant shaped plates the calibrations tend to be a little crowded. Better bandspread can be obtained by using a smaller loop in which case the 144 Mc portion of the band will appear towards the low frequency end. The small loop shown in the photograph on page 53 is 1½" long and the 144 Mc band appears at about the middle of the scale. We calibrated both ranges.

The material used for the loops is 1/8" diameter silver plated copper tubing. The tubing came from some dismantled disposals equipment but ordinary copper tubing or wire would work just as well for all practical purposes. It should be hard drawn wire for preference so that it can be made to plug into the jacks firmly.

The complete grid dip oscillator outfit shown in the photograph on page 49 is one of the most useful test units we have ever had in our laboratory. To house the instrument we eventually intend to make a box from light plywood and divided into compartments for the various items. The box, complete with lid will be covered with leatherette and should be a great help in keeping all the parts together.

CIRCUIT OF THE ORIGINAL UNIT



This circuit, which has been published twice previously, has been built by a large number of our readers.

COIL DATA

COIL A 80 to 33Mc
¾ turn, 20 B & S.
COIL B 34 to 14.5Mc
4 ¾ turns, 20 B & S, spaced ⅜".
COIL C 15 to 6.5Mc
11 turns, 20 B & S.
COIL E 3.0 to 1.4Mc
54 turns, 32 B & S.
COIL F 1.4 to .7Mc
1 ¼" length 32 B & S.
COIL G .7 to .45Mc
2 ¼" length 32 B & S 25 pf condenser in parallel with winding.
All coils wound at top of former.
All coils centre tapped. Centre tap of coils D, E, F and G bypassed to pin 1 with .001 mfd capacitor.

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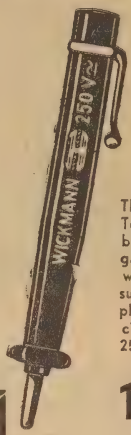

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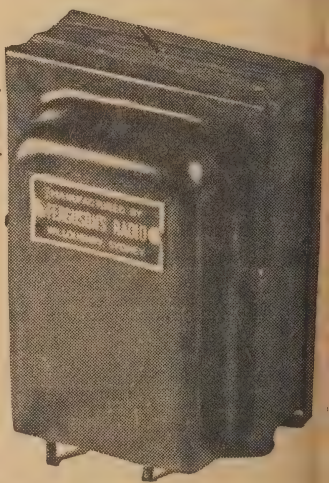

The current amateur window display in John Martin's 116 Clarence Street showroom shows you step by step the manufacture, assembly and testing processes through which every Ferguson transformer passes before it reaches you. This most interesting display is one that every amateur really should see. It takes him right from the actual pressing of the iron laminations through the winding, tying off, forming, sealing and final assembly of a typical transformer. In addition, many interesting photographs show the research and "behind-the-scenes" processes that go on in a modern radio component factory such as Ferguson's. The famous Ferguson range of transformers include the following:—

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MOTOR RUMBLE, FEEDBACK PROBLEMS

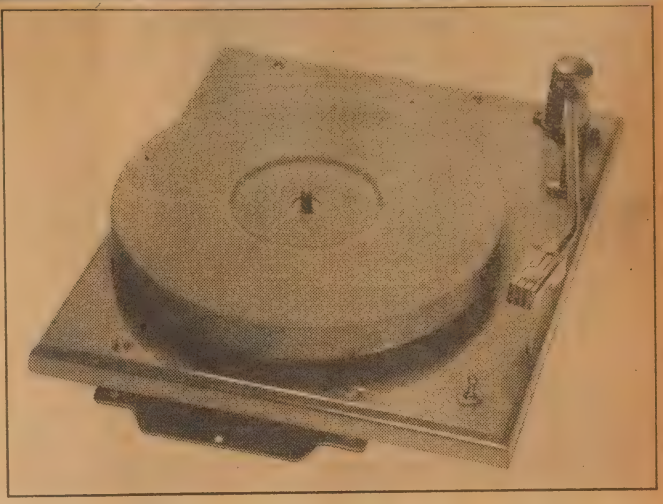
THE first of the problems, namely motor rumble, is of a purely mechanical nature and is the result of such things as unbalance in the drive motor, eccentricities in the drive mechanism, noisy bearings or mechanical vibration of the laminations in the motor itself.

All such imperfections result in vibration which is communicated to the woodwork of the cabinet and radiated into the room as an audible hum or rumble. The trouble is accentuated if the motor board or the cabinet as a whole is of light, resonant construction.

In some cases, also, the vibrations may be communicated to the pickup stylus and amplified along with the music.

The two effects are easy to distinguish, since direct acoustic radiation is evident with the motor only in operation. The rumble due to amplification can be assessed with the pickup running on the silent inside groove of a record and with the volume control at its normal setting.

The obvious answer, of course, is to use a rumble-free motor but, as a general rule, these are found only in the higher price bracket, retailing from £15 upwards.



Finished with a deep chocolate enamel, the shock-mounted motor board has near-professional appearance.

The increasing use of wide range audio equipment has accentuated the problems of motor rumble and acoustic feedback in the cabinet. The following article suggests some ways and means of avoiding these difficulties.

The problem, then, is what to do about the cheaper grade of motor which may conceivably be noisy enough to be heard directly in a quiet room.

If the motor is an old one, the first step is to dismantle and thoroughly clean it. Clean away all old dirt and grease and repack the bearings and drive wheels with new grease or oil, as intended by the manufacturers.

If it uses a governor, clean and oil the pad, also check the springs and weights to see that they are reasonably balanced. Old and distorted springs should be replaced, if possible, with new ones obtained from a music warehouse. Finally, tighten the bolts holding together the motor laminations and carefully re-assemble.

New motors should not need as much attention but it is wise to check the tension on the motor laminations.

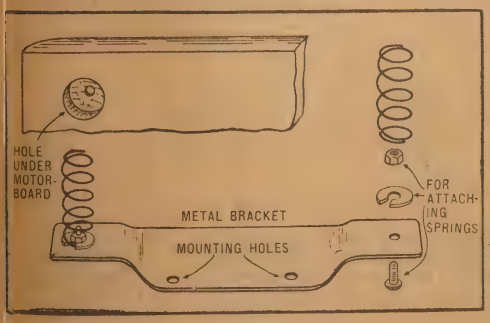
Most of the newer motors operate at normal synchronous speed, the motor hanging beneath the mounting plate and driving the turntable directly or by means of a rubber tyred idler wheel. You can't do much about the inherent balance of the motor, but the rubber bushes can be set so that it hangs lightly from the plate without the bushes being actually sloppy.

Check the surface of the idler wheel for burrs and indentations, likewise the drive surface on the turntable rim. Any irregularities can be smoothed carefully with emery paper.

After that, the motor can be mounted back in position and results noted.

One other simple course is worth investigation, namely reducing the operating voltage on the motor. Many motors, particularly the modern ones, have far more torque than is necessary for playback work and they will run with a large amount of resistance connected in series with one power lead.

One idea is to wire a baton-holder in series with the lead and to plug into it light globes of different wattage. As often as not, the effect of the reduced voltage will be apparent immediately in reduced noise.



Illustrating the attachment of the springs to board and bracket. Note that the washers are split to grip the ends of the springs more effectively.

☆

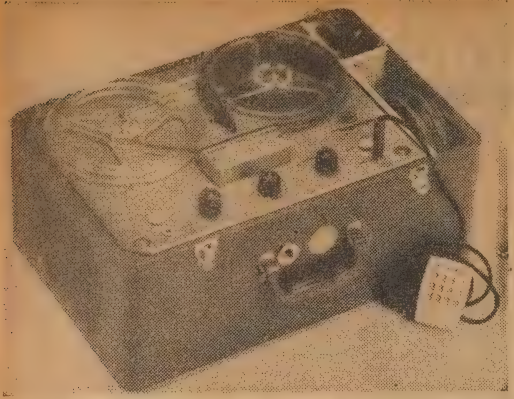
MOUNTING SPRINGS

If the motor noise is still too high, after all this, more drastic treatment may be required and this happily enough is equally effective as a precaution against the other major problem—that of cabinet feedback.

This latter occurs when vibrations from the speaker cone are transmitted by the cabinet back to the turntable and thence into the pickup. They are amplified and fed back into the speaker the net result being that above a certain volume setting, the whole outfit emits an ominous rumbling roar.

Very few single-unit radiograms are completely free from this trouble and all kinds of dodges have been adopted to avoid it. Typical measures have been to suspend the speaker baffle on rubber shock absorbers, rubber mounting the pickup and motor, bracing the cabinet, and so on.

Few of these measures are completely satisfactory for the reason that they only partially isolate the two trouble joints—the speaker cone and the pickup stylus. Fiddling with bits of rubber packing, tightening



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and loosening screws, &c., are temporary expedients which often succeed or fail without apparent reason.

The ideal set-up is one which completely isolates the two units in separate cabinets but, where this is not possible, good isolation can be achieved by mounting the entire pickup and motor assembly on a loosely-sprung motor board. The idea is illustrated by the unit at the head of this article, which was made up especially to deal with the feedback problem.

Enough wood was glued and dowelled together to make up a solid board measuring approximately 12 x 14 x 1in—an overall size which fitted the cabinet space. This was cut, according to maker's templates, to carry the rim-driver motor and magnetic pickup.

It so happened that the motor could be positioned in such a way that it coincided with a hole already cut in the motorboard of the cabinet.

FURTHER STEPS

Next step was to obtain four light springs from the local hardware store with an inner diameter of about 3-8in and just over an inch in length.

By means of sundry washers and 3-16th brass bolts, the springs were attached to two 7in strips of metal which were bent and shaped as shown to attach ultimately to the original motor board.

The new motor board, with pickup and motor temporarily in position, was now checked to discover the line of balance, fore and aft. This was marked and points selected about 3in to either side where the springs would attach.

Next step was to cut clearance holes with a centre bit about two-thirds of the way through the wood. A smaller 3-16in hole was drilled the rest of the way.

With more washers, bolts (and patience), the springs were now locked to the new baseboard so that, when assembled, the complete motor board, motor and pickup could perch above the original position in the cabinet, lightly sprung and free to rock in any direction.

It was found that the four springs provided almost perfect isolation, so that deliberate taps on the cabinet were completely absorbed. In the reverse direction, the small amount of vibration found in the original motor was isolated from the bulk of the cabinet and rendered completely inaudible, even in a quiet room.

To achieve a pleasing and professional appearance, the whole unit was disassembled, the edges rounded, the wood thoroughly sanded and filled, and then finished with two coats of good quality chocolate enamel.

The motor and pickup were then screwed firmly into position, switch added and the whole unit permanently installed in the radiogram cabinet. Care was taken to see that no part of the sprung assembly touched the original motor board.

The result? No audible acoustic rumble, no rumble through the needle point and only the barest trace of feedback with excessive gain and bass boost in operation. In all, we reckoned it a good return for a few bits of hardware and a few hours of work!

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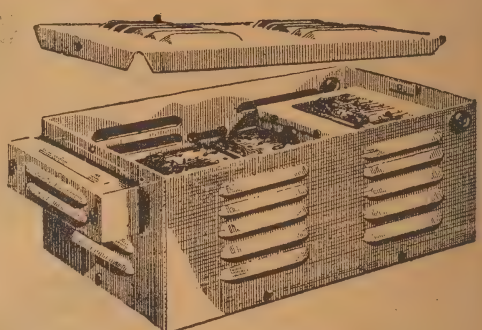

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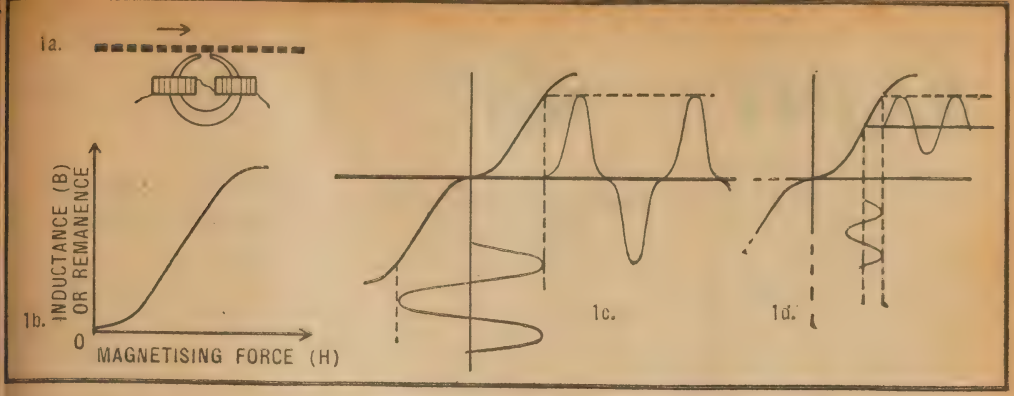

Figure 1: Illustrating the development of the complete BH curve and in (d) the effect of "DC" or permanent magnet biasing.

Magnetic Recording

WHY HIGH-FREQUENCY BIAS IS NECESSARY

One of the most puzzling features of magnetic recording, as far as the newcomer is concerned, is the use made of supersonic or "AC" bias. The subject is highly complex and controversial but the following article should give the reader at least an elementary conception of what is required and accomplished.

THE simplest approach is to consider the magnetic wire or tape as being composed of a large number of individual bar magnets which are drawn by the mechanism past the magnetic recording head.

The physical size of these magnets and their speed of travel is such that they move past the recording gap in a much shorter time interval than is occupied by an audio cycle, except at frequencies approaching the cut-off limits of the system.

Thus, for the purpose of discussion, it may be considered initially that, as each tiny bar magnet passes the head, it encounters a fairly steady magnetic field, determined by the strength of the audio current in the head at the particular instant.

MUST BE LINEAR

If the audio current is to be recorded faithfully throughout the whole cycle, the degree of magnetisation retained by each tiny bar magnet should be strictly proportional to the strength of the audio field at the instant when the magnet passed the head.

To use more correct terminology, the "remanence" of each particle should be a linear function of the current through the head at the instant of recording. This is where the first difficulty occurs.

Let us imagine that a length of wire or tape, representing a sequence of extremely small magnets, is drawn past the gap in a recording head and that, at the same time, the current through the head is advanced in steps from zero to some considerable value.

ACTUAL CURVE

If it were now possible to examine each particle in detail and measure the degree of residual magnetism (remanent-induction), points could be plotted on a graph showing the relationship of remanence to magnetising force. By joining all the points together, a smooth curve would be produced similar to figure 1b.

The immediate point of note is that the relationship between the two functions is by no means linear, the curve taking on an elongated "S" form similar to the dynamic operating curve of a valve.

With low values of energising current, there is a pronounced lag in the build-up of magnetisation. Thereafter, the curve is fairly linear until a top limit is reached beyond which an increase in the magnetising current is not reflected by additional magnetisation of the particle. In this region, the particle is said to be "saturated."

It is important to remember that the curve of figure 1b is for the build-up of current through the coil in one direction only.

However, in recording an audio signal, the current through the head is of a cyclic nature and periodically reverses its direction of flow. The polarity of magnetisation is therefore periodically reversed so that it is necessary to place these so-called "BH" curves end to end as in figure 1c.

Thus the overall curve of remanance against magnetising current for a complete AC cycle is markedly non-linear, having curved ends and a serious "kink" in the centre portion.

This non-linearity was the source of most of the distortion which characterised early attempts to record magnetically and success did not follow till the idea of magnetic bias was conceived and applied.

"DC" BIAS

The first and obvious approach was described rather loosely by the term "DC bias." Essentially, this meant subjecting the wire or tape to a permanent magnetic field simultaneously with the audio field current. It could be accomplished, for example, by passing DC through the head as well as the AC component.

The effect, as illustrated in figure 1d, was to move the reference point along one portion of the BH curve, midway between the curved regions of zero magnetisation and of saturation. By careful control of the DC and AC components, a substantially

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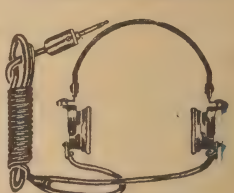

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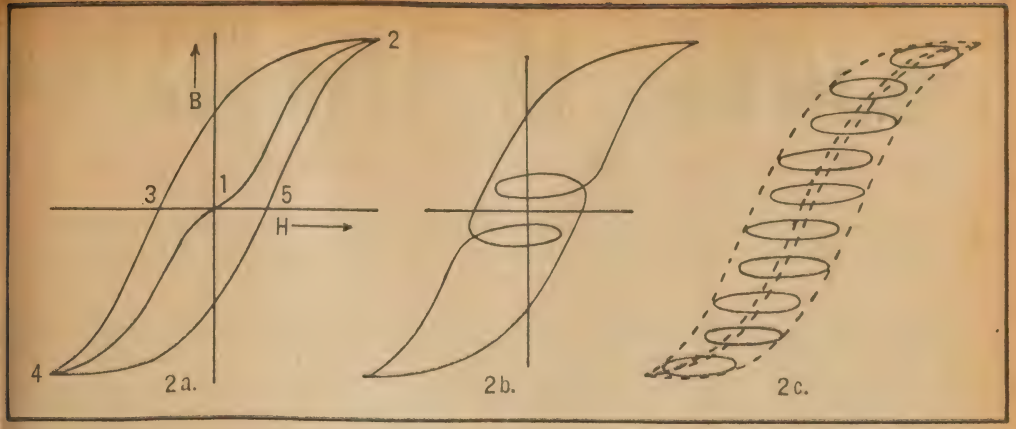

Figure 2: What happens when a magnet is carried through several magnetising cycles. (b) and (c) shows the relationship of major and minor hysteresis loops.

linear characteristic was obtained.

While apparently a very simple system, the adjustment of the applied DC bias is very critical, if the operating point is to be set accurately on the linear portion of the BH curve for the type of wire or tape in use.

Even then, only a limited amplitude of signal can be applied before overload sets in. Since the lower limit of signal amplitude is already set by the inherent noise of the system, the use of DC bias leads to a severe restriction of the useful dynamic range. In other words, the ratio of the maximum to minimum usable volume level is limited.

"AC" BIAS

The so-called "AC" or "supersonic" or "high frequency" bias system overcomes this objection but its operation is not nearly so easy to explain.

Instead of using a DC bias current, as already explained, a high frequency alternating current is passed through the head as well as the required audio signal. The high frequency alternations are so rapid—50 Kc or more—that each bar magnet reaching the gap is subjected to several complete magnetising cycles at bias frequency, before it passes beyond the influence of the field.

Before we can go any further, it thus becomes necessary to study objectively the reaction of any magnet subjected to an alternating field. Let us therefore figuratively switch everything off, so that a particular particle on the tape remains stationary over the gap in the recording head.

Now, still following this objective study, let's pass an audio wave only through the head and increase its amplitude to the point where it can saturate the "guinea pig" particle on current peaks. Look at figure 2a.

During the first quarter cycle, the remanent induction would be found to follow the BH curve from 1 to 2, the latter point representing the peak of the current cycle.

During the next portion of the cycle the current diminishes and reverses direction and one would expect the induction value to fall back along the same BH curve. In actual fact, it does not do this but falls back along a line on the graph passing through 3 to the reverse saturation point at 4.

To complete the cycle, the induction plot follows the line from 4, through 5 and back to 2. During successive cycles, the value of induction continues to follow this outer and so-called major hysteresis loop, without any further reference to the original BH curve.

Now the interesting point about the major loop is that its sides are substantially straight and much would be accomplished if the remanent induction of the magnet could be related to these straight sides rather than the original BH curve. This is the ultimate objective but let's not get ahead of ourselves.

Thus far, we have introduced audio current only and used it to produce a major hysteresis loop.

Now, while still maintaining the audio current at this saturation value, let's introduce just a couple of odd cycles of the much higher frequency "bias" current but keeping its amplitude fairly low. Look at figure 2b.

As the audio current continues to run the particle through its major loop, the two high frequency cycles we have surreptitiously introduced run the particle through two complete minor loops and the way they fit into the general picture can be readily seen.

Now the only purpose in mentioning two cycles of bias is to make the graph easy to draw and to visualise. In actual fact, once the bias current is introduced into the head, it whips the particle through possibly hundreds of minor loops while it is simultaneously trying to pass through a major loop.

ACTUAL PATTERN

Thus, if the pattern were to be completed in detail it would involve drawing numerous minor loops and these minor loops, grouped closely together would form the general contour of the original major loop.

If the strength of the original audio signal is now reduced to something less than saturation value, the minor loops simply pack closer together and the contours of the major loop retreat from the saturation peaks.

One important observation can be made from 2b and 2c namely that the geometric centres of the minor loops all lie along a more or less smooth curve, which is substantially a repetition of the smooth sides of the major hysteresis loop. We shall see the significance of this in a moment.

Having now made an objective study of magnet behavior, let's come back to the practical condition in a wire or tape recorder. Set the tape in motion past the head and switch on only the BIAS current.

Now as each particle approaches the gap, it will come more or less gradually under the influence of the high frequency field and pass gradually beyond it. In other words, each particle will be swung through a minor bias loop for several cycles, the loop collapsing gradually as the particle passes out of the field.

LEFT INERT

Since there is no DC or audio component present yet to disturb things, the minor loop is centred on the axis of the graph and the collapsing loop leaves the particle magnetically inert.

Say now that AUDIO is switched into the head, as well as the bias current.

The next group of bar magnets to approach the gap will commence swinging through a minor loop, exactly as those before but now the audio component may simultaneously be carrying the induction upward along the major loop. (Fig. 2c).

The upward trend will not progress far before the particle moves away from the gap and this simply means that the minor loop begins to collapse from a position displaced (say) above the axis.

So it collapses to the geometric centre of the displaced minor loop. And here is the important point—the geometric centre lies on the dotted and smooth curve in figure 2c, not on the original and irregular BH curve.

So the process continues, each successive group of particles being swung into loops displaced from the axis by an amount proportional to the instantaneous value of the audio current.

(Continued on Page 93)

A COURSE IN TELEVISION

PART 28 — FLYBACK TYPE POWER SUPPLIES

As mentioned in previous articles, the flyback power supply is now widely accepted as the standard EHT system for domestic television receivers. This article describes the circuit and typical components now in use.

IT will become obvious during discussion that the flyback type power supply is closely linked with the widespread use of magnetic beam deflection. Magnetic deflection, in turn, has been preferred for large direct-viewing tubes because of the difficulty of achieving adequate deflection by other means.

In the normal way this situation would probably have remained unchanged for a long time to come, but factors are arising overseas which may conceivably alter the position again.

The most important one is an increasing shortage of the strategic materials used in the manufacture of magnetic deflection yokes and transformers. It has intensified research into electrostatic deflection and pilot model receivers have been developed in the US particularly in which this principle has been applied successfully to fairly large tubes.

Progress has also been made with special screens and optical systems for small-tube projection systems and this will also have an important bearing on the whole question of deflection systems and EHT supplies.

If the change does come about on a large scale there may be a reversion to RF power supplies, but this remains only as a possibility. In the meantime, the conventional flyback system has become soundly established in favor.

The subject of deflection amplifiers was discussed in part 25 of this series, the line deflection amplifier being the one of particular interest here. It was pointed out that the short retrace time between lines and the accompanying rapid change in amplifier plate current produced an extremely high counter EMF across any inductance connected in the plate circuit. Even under ordinary conditions the peak value could easily exceed two or three KV.

Because of insulation problems it is difficult to design deflection coils which can withstand this voltage directly. Instead, the line deflection amplifier is normally coupled into a special transformer having a low-voltage, high-current secondary, which feeds low-impedance coils around the neck of the picture tube.

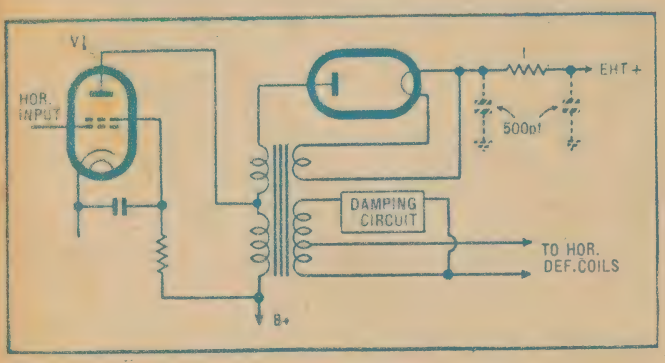

Figure 1. The simplified circuit for a flyback type power supply. Compare this with figure 3 opposite.

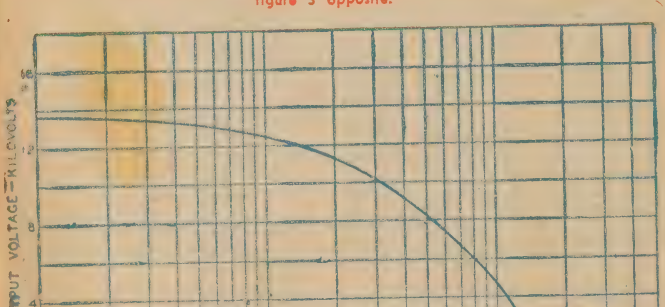

Figure 4. The voltage regulation characteristic of the flyback power supply shown in figure 3. Note that the feasible load current is limited to a small fraction of a milliamp.

USES HIGH VOLTAGE

The flyback power supply simply makes use of the otherwise embarrassing surge voltages, the output transformer being re-designed to perform both functions.

Figure 1 illustrates the principles of the flyback circuit. Valve V1 is the horizontal output tube, which is normally characterised by good power output and good high-frequency characteristics.

Its plate circuit is fed from B-plus through what is essentially the primary winding of the horizontal output transformer. This transformer has the normal secondary winding to feed the deflection coils, the secondary being extended in order to match efficiently into the damping circuit.

A further winding, which may comprise a couple of turns of heavily insulated wire, feeds the filament of a high voltage rectifier in exactly the same fashion as in a conventional RF power supply.

POSITIVE OUTPUT

High voltage input to the rectifier is taken from the primary circuit, the phases being so arranged that the rectifier delivers positive DC output from its filament as a result of the back EMF from the flyback pulse.

In some cases the voltage obtained directly from the horizontal amplifier plate may produce adequate EHT voltage, but, where this is not so further steps must be taken. The most obvious course is shown in figure 1, where the normal primary winding is extended beyond the feed point for the plate. The surge voltage at the top of the winding is

herefore, increased by auto-trans-ormer action and may easily be pushed up to 10 KV if required.

A further method is to employ a voltage multiplying circuit and two or more rectifiers, this scheme being particularly applicable to very large tubes or projection types, which require an abnormally high EHT voltage.

In actual fact, a good deal of extra circuit complication builds up around this portion of the receiver, some of which has already been mentioned. In addition to the EHT circuitry, it is common practice to feed the power from the diode damping circuit back to the horizontal amplifier plate to improve its performance on signal peaks.

TYPICAL CIRCUIT

Linearity and other picture controls also tend to be concentrated here, and the best approach is probably to study in detail the appropriate section of a typical receiver circuit. The constants are as suggested by the American RCA Company for their 16AP4 kinescope.

It must not be assumed that all designers follow this type of application data in detail, any more than is done with ordinary AM broadcast receivers. It is a fair indication, however, of an approved design approach and can well be studied in detail.

The horizontal output tube is a 6BG6-G, which is a special type developed for this class of service. It is a beam power design with characteristics somewhat reminiscent of the familiar 807. A special point of note is the 6000-volt peak surge rating on the plate.

As indicated on the diagram, the input signal from the sweep oscillator should have a peak-to-peak value between 40 and 70 volts. Since a sawtooth current must be produced through the deflection coils, the sawtooth voltage input to the amplifier grid must have the specialised form shown and the reason for this was explained in part in article 24 (May, 1951).

CIRCUIT IN DETAIL

Cathode and screen circuits for the 6BG6-G require no comment, but the plate is fed through the composite transformer which feeds both the deflection coils and the EHT rectifier system.

Tracing through the plate circuit of the 6BG6-G reveals the fact that there is no metallic connection to the B-plus line. It flows, instead, through L2 to the cathode of the 6W4 damping diode, thence across the diode to B-plus. On the surface, this scheme would appear merely to introduce a needless impedance into the plate supply circuit.

In point of fact, when the 6BG6-G is delivering output, considerable voltage appears between terminals 4 and 6 on the transformer, and this is applied across the 6W4 for purposes of damping (see article 25).

In the process, however, a rectified potential appears across the diode circuit and adds to the normal B-plus supply voltage. Thus, even though the steady HT voltage is 375 at the point of supply, the voltage measurable at pin 1 of the horizontal transformer is 460, the peak value being higher than this again.

Total cathode current for the 6BG6-G under dynamic conditions is approximately 100 to 120 milliamps, representing 38 to 42 input watts. Of this amount, six watts is recovered by the damping diode and fed back into the plate circuit by the "power feedback" arrangement. The interconnection of the damping diode and amplifier plate is well worth while as an economy measure, being particularly valuable in receivers designed to operate from a moderate HT voltage.

In this case, the deflecting coils are connected between pin 4 and 6 on T1, representing the full secondary winding.

A number of controls are associated with this portion of the circuit, most of them being for pre-adjustment of the picture and not normally available to the set user.

Switch S1, connected to pin 5 of the output transformer, brings L1 into shunt with portion of the output transformer secondary. Its inductance is variable and, by changing the shunt load on the winding, the exact picture width can be controlled.

Coil L2 is also variable and affects the shape and magnitude of the voltage pulse fed from the damping diode into the plate of the horizontal amplifier. So also does R10, two being set for best horizontal linearity.

(Continued on Page 81)

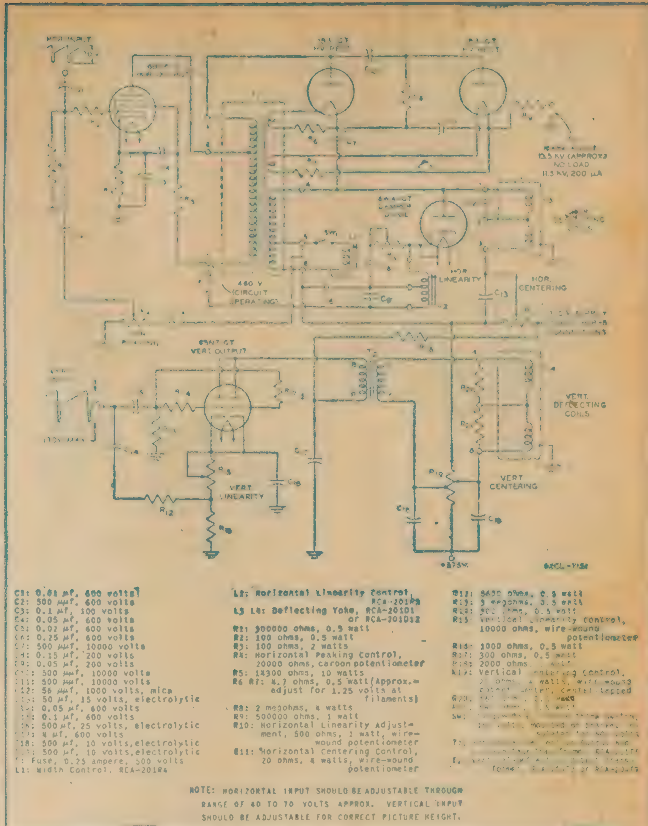

Figure 2. The complete power supply and deflection system for a 16" tube, as recommended by tube manufacturers. Note how intimately the various functions are interwoven.

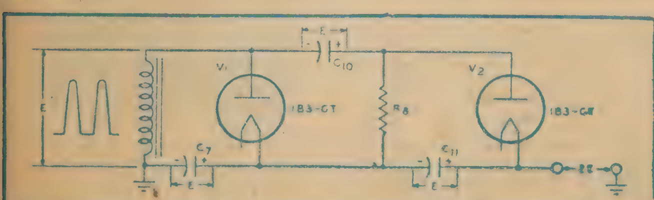

Figure 3. A simplified presentation of the voltage doubler circuit. Its operation is explained in the text.

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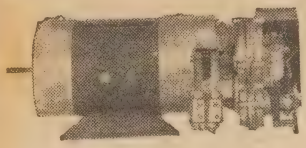

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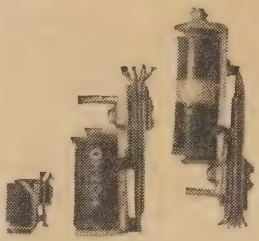

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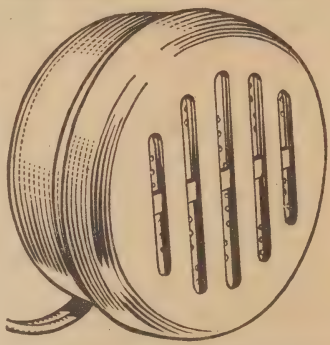

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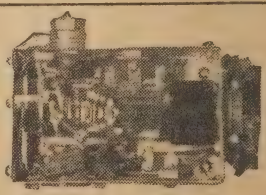

METROPOLITAN RADIO SUPPLIES

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FROM THE SERVICEMAN WHO TELLS

Continuing our discussion on test instruments for a serviceman, I am dealing this month with the oscillator—what it should and should not do, and what to expect of commercial instruments. This month's prize fault was a routine job that turned out to be anything but that!

WHILE it is generally agreed that the multimeter is the first piece of equipment for the budding serviceman to acquire, the order of subsequent items is often the subject of quite heated arguments. I have known suggestions to vary from vacuum tube voltmeters to oscilloscopes, apparently due to the mistaken idea that one or other such device is a kind of electronic cure-all for any kind of service problem.

This is a complete fallacy of course. These and other devices are extremely valuable in their own field but many of them are not even designed as service aids, being intended for the laboratory and design engineer.

USES

Coming down to more logical suggestions it seems to be a toss up between a valve tester and a modulated oscillator, with most of the evidence in favor of the latter. This assumes that, having bought a particular piece of gear, you may have to wait several months before you can consider your next and that, in the meantime, you require the greatest possible usefulness for your outlay.

In saying that the oscillator seems to offer this, I should perhaps point out that it is not merely used to check alignment after the major portion of the service work is finished. In fact, this is merely a routine job of comparatively minor importance. The oscillator's real value is its ability to measure the gain of the set, stage by stage, until a faulty section is isolated, at which point the multimeter can take over to find the particular component.

Used intelligently it can even deputise to some extent for the valve tester, enabling a suspected valve to be checked accurately against one known to be good, by comparing their performance in a receiver. Providing one has the necessary standard valves this method is often to be preferred, as it is a dynamic test in the true sense of the term.

SELECTION

However I didn't intend that this should be a discussion on how to use an oscillator but rather on how to select one. I do feel nevertheless that the foregoing points may help to justify my selection of it as next in line.

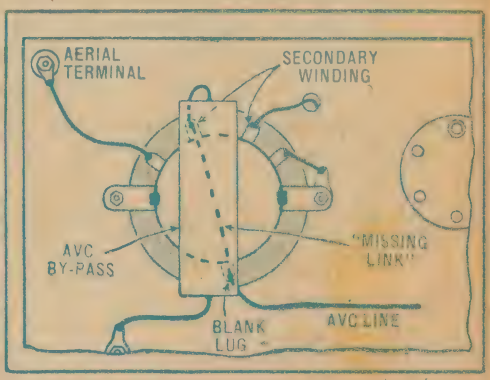
When it comes to the actual selection of an instrument there are many points to be considered. In the first place, it is necessary to make a clear distinction between the experimenter and the serviceman. The experimenter's requirements are not always highly exacting, time is seldom a major factor, and he often feels that the limited application hardly justifies a large outlay.

But he does need some kind of oscillator and reasons that even the simplest device is better than nothing. As a result he usually finishes up with a simple one valve affair, modulated with 50 cycles on the plate or a "squeeger" circuit, with a 0-100 dial and a sheaf of calibration graphs.

Now don't get me wrong—these humble devices have their place and, no doubt, such designs will continue to be published for the benefit of those who need something at a minimum cost, or who just want to try their hand at something simple for a start. As I say, they have their place—but it's scarcely on the serviceman's work bench.

Here the requirements are accuracy, reliability, and ease of working and these cannot be sacrificed in the interest of first cost. After all, time wasted due to an inefficient instrument can be regarded as money "down the drain," and it doesn't take many wasted hours to account for your so-called "saving." After that the thing can be regarded as a dead loss.

Look at it another way. If you outlay money, you expect to get value for it, but you won't get that value if you try to make a cheap instrument do a job for which it was never fitted. Or again, look upon it as a tool of trade, as it most certainly is, and remember that it has to earn money for you. It must be an asset and not a liability.



This drawing shows how the AVC by-pass condenser hid the two lugs on the coil former which should have been joined to complete the AVC circuit. Lack of AVC or bias caused serious overloading on strong signals.

Good general advice is "buy the best you can afford," but there is really more to it than that. You have to be able to afford something better than those I have mentioned. If you can't—well you'll just have to wait until you can.

What does all this mean in terms of what to avoid?

Well as I have already stated, 50 cycle modulation, self modulation ("squeegers") and hard-to-read dials are "out." So is battery operation, unless there is a very special reason for it. At one time this was considered the only way of ensuring minimum RF leakage, but there is really little to support this idea, and the only other claim is lower first cost. This loses its attraction as soon as we consider the higher running cost, plus the fact that the batteries always choose the most inconvenient times to fade out.

PORTABILITY

Extreme portability is not likely to prove the advantage that it may at first appear. In the first place, it usually means that something must be sacrificed in the way of efficiency but, in any case, is it really necessary? Usually when a set is in such a condition that it cannot be serviced with a multimeter it is time to bring it back to your workshop. After all, there is a limit to what you can carry to a job, and this is about reached when you have a multimeter plus tools and spares.

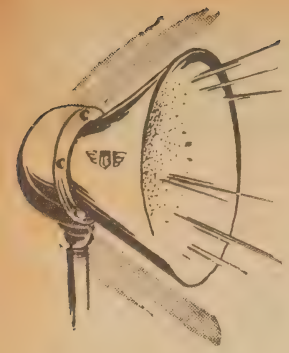
So much then for what to avoid. What are the features we require?

First the coverage. The minimum requirements here are the IF bands, both 175 and 455 kc, the broadcast band from about 500 to 1500 or 1600 kc, and the more popular short-wave bands between about six and 23 mc.

Some may query the need for the 175 kc coverage as this IF is no longer used, but believe me there are plenty of these old sets still going strong, and in addition this frequency was used in a number of car radios until just recently.

The 175 and 455 positions are usually located at opposite ends of the same band, and if this does not overlap into the broadcast band make sure that there is sufficient margin on the high frequency side of 455, as some receivers employ a figure as high as 470.

Full coverage of the broadcast band is not difficult to provide with one band, and in most cases this is



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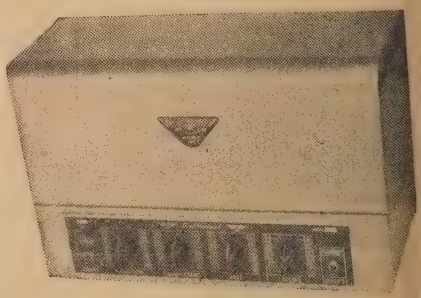

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to be preferred. However some designs provide "spot frequencies" where the bands are so arranged that a single setting of the dial corresponds to a number of popular frequencies such as 175, 455, 600, 1400, &c., and these may be selected by simply rotating the band selector switch. This is a very worthwhile feature and quite a convenience, but unfortunately is usually found only on the more expensive models.

In a very few designs, only a single band may be provided for the short-wave coverage, in which case it should cover as much as possible of the 6 to 23 mc band, but in most cases coverage is complete from the broadcast band to 28 or 30 mc. This is sufficient for present day requirements, but does not extend into the UHF spectrum where the future television and FM stations will be located. Since there is much speculation at the moment as to just when these will become a regular part of the serviceman's routine, it would seem wise not to regard these frequencies as a major requirement. This is the more so since the IF for these sets is already covered by standard instruments.

ACCURACY

The question of accuracy is rather a vexed one. There is no doubt that the ideal would be something approaching that of broadcast stations, but anyone who expects this from a commercial oscillator is doomed to disappointment, for the usual figure, even on expensive models, is around 1 pc.

While this may sound good before you stop and think, it must be realised that it represents 10 kc at 1000 kc (the middle of the broadcast band). This difference is quite noticeable when checking against the broadcast stations and often leads the purchaser to believe that his instrument is faulty, when, in fact, it might be well within tolerance.

Some instruments are calibrated to higher degrees of accuracy at specified points on each band, usually somewhere near each end, such as 175, 455, 600 and 1400 kc, &c., but even so the figure is not likely to exceed .5 pc.

All of which raises the question as to just what degree of accuracy is really necessary. Strictly speaking the 1 pc is not as good as could be desired, but we are faced with the problem that to get anything substantially better would put the cost up out of all proportion.

STABILITY

This simply means that we must learn to use our own instrument to the best advantage and, to this end, the stability or reset capacity assumes as much importance as does the actual calibration accuracy. If the instrument is stable, both electrically and mechanically, it does not take long to learn the amount of error which is present at the frequencies you most commonly use. Most of the very cheap designs fail in this respect and when this feature is lacking they become virtually useless.

Leakage is RF energy radiated from the oscillator and picked up by the set under test, as distinct from that which is fed into the set via the output cable and attenuator. Leakage RF is therefore not subject to the control of the attenuator and when it is present in any appreciable amount makes it very difficult to measure the sensitivity of a receiver. At frequencies above the broadcast band this effect can be very difficult to eliminate, calling for multiple shielding and very careful layout.

Once again we are faced with the problem of cost, and the medium priced units are usually something of a compromise, the designers usually being content to reduce the effect to negligible proportions on the IF and broadcast bands. In practice this usually works out as a satisfactory arrangement, but it is as well to guard against really excessive leakage even at the higher frequencies.

The attenuator is intended to control the amount of RF fed to the circuit under test and at the same time indicate that amount so that the sensitivity can be calculated. At the best this device can only control the amount of energy fed to it and, since this varies from band to band and even within the bands, with the energy of the oscillator, any attempt to calibrate it can only be approximate. Usually a simple 0-100 scale is all that is required and the user will soon learn the settings which are normally required for various connections to a normal receiver.

ATTENUATORS

In the more expensive instruments metering systems are used to ensure that the same amount of energy is always fed to the attenuator, in which case it may be calibrated directly in microvolts. Sometimes the attenuators on cheaper instruments are also calibrated in microvolts, but you can take that one with a large lump of sodium chloride!

More important than the system of calibration is the reset accuracy, exactly as in the case of the frequency calibration, since, if this is good, satisfactory comparisons are possible and this is really all that is required. Another point to watch is that there is no leakage through the attenuator itself, which gives an effect similar to the RF leakage already mentioned. However, it is often due to a potentiometer which has residual resistance at the zero end, in which case the leakage will be bad even at low frequencies.

Once we eliminate modulating systems like the "squeeger," &c., the natural choice is a 400 cycle generator consisting of a separate valve and associated circuit arranged to modulate the RF to a depth of about 30 pc. It is desirable to be able to remove this modulation if required to facilitate tests for modulation hum, AVC, &c., while a 400 cycle outlet is extremely useful in testing the audio end of the set.

Taking the minimum requirements as outlined above, we find that a commercial instrument will cost something between £20 and £25, while for £40 or £50 you can get a de-luxe model with everything that opens and shuts.

DEARER MODELS

If you can really afford one of the latter you will certainly have a very nice instrument, but it is worthwhile to stop and consider just how many of these extra features will really benefit you as a serviceman. Such things as low-distortion, 400-cycle audio generators, facilities for external modulation, extremely accurate attenuators complete with metering systems are all valuable in the design laboratory, but are not so important in straight-out service.

On the other hand, some fellows consider they have a use for these features outside their normal service work, in which case the money will be well invested.

So far, I have only discussed commercial instruments but, where finance is a problem, there will be many who will prefer to make their own. There is no objection to this provided all the requirements already dealt with are kept in mind.

There have been quite a number of circuits published in Radio and Hobbies which should fulfil these requirements, but it must be realised that the performance of the finished unit depends as much on the workmanship as on the electrical design.

This means that, although you may save £10 or £15 in actual outlay, you must be prepared to devote a fair amount of time to such a project if the finished job is to compare with the commercial version. If you have the time available and feel you have the ability to make a satisfactory job, completely finished with calibrated dial, properly labelled controls, &c., then go ahead. On the other hand, if your time is limited or you feel diffident about tackling such a project, the commercial unit would be a better proposition. So much for that.

A ROUTINE JOB

This month's story concerns a set which I at first regarded as a purely routine job. It started when the owner left the set running unattended for a couple of hours, and returned home to find the house full of smoke and the characteristic smell of a somewhat overcooked transformer.

Mind you, a set should not fail simply because it is left on for a few hours. Many sets run from dawn to midnight as a "habit." The point is that sets do fail sometimes, and it is a good idea to be around when it happens!

Really, he was very lucky, for I have known of serious fires started in this way, but apparently, in this case, the primary winding had opened fairly early in the piece, though not before the transformer was completely ruined and the chassis coated with a thick layer of impregnating wax.

The set certainly looked and smelt

7-BAND TEST OSCILLATOR

FURTHER work on the 7-band Test Oscillator, featured in the June issue, indicates that the overall performance of the oscillator can be improved slightly by the substitution of a 50,000-ohm, ½-watt resistor for the chokes in the plate circuit of the Z77.

If located close to the plate pin, the resistor serves as an effective RF load, rendering the chokes unnecessary. The reduced plate voltage and distribution of potentials across the valve renders the circuit more proof against frequency variation both with modulation and line surges.

Increased grid current is also obtained on the 30-100 Mc band.

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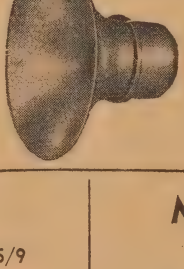

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horrible, and the owner was in some doubt as to whether it was worth fixing, particularly as it was a fairly old model. While not exactly the latest type, it did at least boast a six-volt series of valves, and I pointed out that it was worth a good deal more than a lot of sets I come across—sets which should have been ditched long ago, but whose owners insist that they are capable of performance "far better than anything you can buy today."

REPAIRS JUSTIFIED

Taking all things into account, I considered that this was a case where the cost of repairs, although a little higher than usual, was justified, and I advised the customer accordingly.

Having removed the charred mass that was once the transformer, I was faced with the task of cleaning the chassis. Although not vital to the performance, I could hardly return it in its present grimy state, for an owner will often judge a repair as much on appearance as performance.

The bulk of the wax was scraped off with a knife, and most of what remained responded to a cloth soaked in methylated spirit.

Most of the wires from the transformer had suffered in the heat, the rubber and cotton insulation being badly charred in many cases. These had to be replaced, which was quite a big job, as many of them were lengthy and formed part of rather elaborate cable forms. The power flex also had to be replaced, not due to the heat, but simply old age, the rubber cracking wherever it was bent.

BOTH CONDENSERS

Although only one electrolytic had actually broken down (thus starting all the bother), it would have been poor policy to replace this one only, for its companion was almost certainly on the way out and would need to be replaced in a few months, anyhow.

The original condensers had been the can type, mounting directly on the chassis, and, to make a firm job of the pigtail type, I had to mount a small tag strip under a convenient bolt. This completed the wiring, and I proceeded to check the rectifier in the tester. Strange to say, it tested good, with plenty of emission, and looked to be good for a long time. I was rather surprised at this, for it must have taken a pretty solid lacing, to judge from the condition of the transformer.

But as the tester said it was good, I plugged it in, connected the voltmeter across the HT, and switched on. Nothing happened, and a quick check showed that the rectifier filaments were not alight. Further investigation revealed a thin film of burnt varnish in the socket pins, and when this was removed the rectifier functioned normally, and the set showed some signs of life.

The wax was one possible reason why the rectifier had survived, as it may have opened the filament circuit before too much damage had been done. The only other explanation I could think of was that the transformer had ceased to deliver HT soon after the condenser broke down, but had so damaged itself at this stage that it had plenty of shorts of its own, and had continued its job of self-destruction.

But, to return to the set. Although the HT had been restored and there was evidence of the audio section functioning, this was about all I could get from it. It did not take long to establish that the IF amplifier was not working, and that it had no voltage on the plate. From here, it was only a step to confirm what I had begun to fear — an open-circuited IF transformer.

Just why or when this had occurred was hard to say, for it certainly could not be blamed on to the condenser breakdown and subsequent happenings. However, one possibility did occur to me. If the transformer had failed while the set was running, but before the owner had left the house, it could account for his having forgotten to turn it off for, with the set silent and no dial lamp (it was burnt out), this would be all too easy.

Now I had the additional job of repairing or replacing the IF transformer, and I was hoping that the former would be practicable. I realised that it was a 175 kc job, and one of the old air-core variety into the bargain, which did not make the prospects of a replacement very bright.

INTERNAL BREAK

Alas, it was not to be. All my checking only confirmed that the break was somewhere well inside the bobbin and that a replacement was the only way out. First, I tried the makers, hoping to get one of the same type, but none was available. There seemed only one course left, and that was to use a modern iron-cored type and hope that the additional gain would not prove troublesome, or that if it did, some damping resistors across it would tame things down.

The original transformer had used only four small holes to pass the leads through to the underside of the chassis and to accommodate the modern one I had to cut a large hole with a socket punch, and by the time this was done and the wiring completed I was beginning to wonder if I had done the wisest thing in recommending that the set be repaired.

The reception of signals consoled me somewhat—but not for long! The weaker locals came in well, but on the stronger ones the set was hopelessly overloaded. It seemed a clear case of faulty AVC and I attacked this part of the circuit with the VTVM.

AVC voltage was being generated across to the load resistor and I was able to trace it in turn to the IF transformer, RF coil and aerial coil. Next I tried the grids of the valves and found voltage on the IF amplifier and converter, but none on the RF amplifier. Since the voltage was being fed to the coil I had visions of another open circuit winding.

THE "MISSING LINK"

A check with the ohmmeter confirmed that there was no continuity between the grid lead and the lug on the bottom of the coil where the AVC line terminated, but a more careful examination showed that this was a blank lug with no part of the coil connected to it.

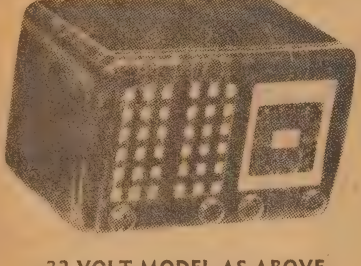
The lug terminating the secondary winding was eventually located directly opposite and, while it was bypassed with the usual AVC bypass condenser, it had no DC connection to the AVC line or anything else. From the nature of the joints it was fairly clear that this section of the set had not been tampered with and I could only assume that the set had always been like that.

A further survey of the layout showed that it was far more convenient to bring the AVC line to the blank lug than the one opposite, and presumably it was intended that these two lugs be joined with a short link, but this had never been fitted.

The position of the AVC bypass condenser was such as to obscure this link, or where it should have been, which probably accounts for its absence not being noticed. Nevertheless, it does not say much for the final test of that particular factory which let such a mistake pass.

Needless to say, the application of AVC voltage to the RF stage cured the overloading and the set performed really well, undoubtedly one case where it really was better than it had ever been.

September Specials



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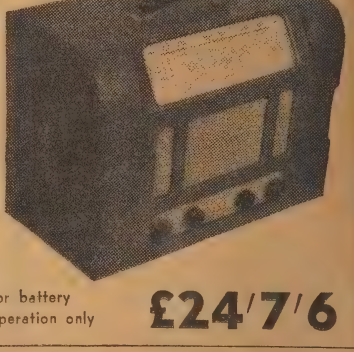

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24V	250V	100MA	£2 0 0
24V	250V	60MA	£1 10 0
24V	300V	250MA	£2 5 0
12V	210V	60MA	£2 10 0
12V	310V	50MA	£1 10 0
24V	360V	260MA	£3 10 0
12V	275V	60MA	£2 0 0
12V	550V	140MA	£5 0 0
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USING THE 12A FOR MICROGROOVE

The model 12a pickup made by HMV is something of a standard with broadcast stations and many home installations because of its ruggedness, performance and possibilities. Some little time ago we showed how by reducing armature mass and increasing compliance even better results could be obtained. Our latest experiments have shown the 12a to be quite suitable for modification for microgroove records.

By JOHN MOYLE

☆

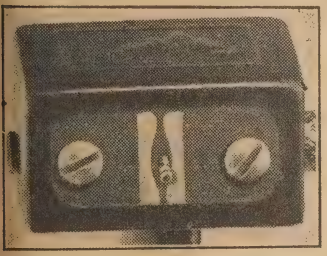
Rear view of the pickup base showing the aluminium cup and sheet lead weights clamped in it.

☆

THE armature of the 12a is mounted on a narrow metal strip stamped out of the spring steel armature plate. This metal strip forms the armature suspension, and is damped by a small square of rubber material which clamps under it.

Although the original compliance of the pickup and its effective weight of 1¼oz (35 grammes) is not excessive for 78 records, we were able to improve performance by filing down the metal forming the armature to reduce its mass, filing away portion of the metal strip of the spring steel armature plate to increase compliance, and by counterweighting the head still further to reduce stylus point pressure. Using a lightweight sapphire stylus, we managed to increase the resonance from about 9Kc to 17Kc and in some cases even higher.

By substituting a high impedance coil from an old Headmaster cartridge for the original low impedance



Retouched photo showing exact shape of armature suspension after filing.

coil (it fitted exactly) output was increased. The final result was most impressive as regards frequency range and low distortion.

The requirements for a microgroove pickup are even more exacting. Effective stylus pressure must not exceed about 8 grammes, and compliance must be reduced to allow perfect tracking at this low weight.

It seemed probable that with a little extra care, the 12a should be made to meet the case.

The armature tip was filed down to a mere wafer—at least one third of its original thickness. It was not reduced in area as we wished to avoid dropping output, although filing from the top would help to keep resonance high.

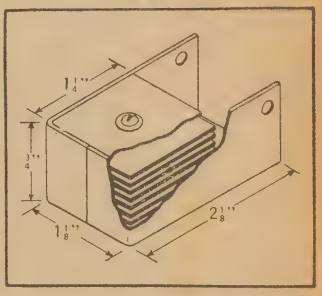
The suspension was filed away quite severely but not enough to make the pickup really fragile. As a guide we show here a close-up photo suitably retouched to show the exact shape of the suspension strip. The work was done with a fine, shallow jeweller's file, and takes only a few minutes and some care. Testing with finger pressure, resistance to movement of the stylus is extremely low.

The pickup was counterweighted by making a small bracket of aluminium mounted to the arm by the same piece of threaded rod as supports the present counterweight. Again the pictures are better than words, so two illustrations are included. The extra weight is made up of lead sheet sections. A single bolt holds these in place, but the weight could be made removable from its aluminium "cup" if desired to play 78 records. The stylus would of course need to be changed as well.

The total weight of the attachment is 6¼oz. In our case this resulted in a stylus pressure of about 4 grammes only, which is much lower than any pickup tested to date. Despite this truly featherweight, we have not yet played the record with which it will not track perfectly. The exact value of counterweight should be adjusted for each pick-up. Microgroove stylii are available, and should be cemented in place with a touch of acetone cement.

In the base of the pickup there is a spring tension device to load the ball race which takes the pick-up weight. It may be necessary to reduce this tension, or to remove it completely, to allow the arm to swing more freely. No other adjustment was required to the arm suspension.

The absence of microgroove frequency records has prevented a frequency run on the pickup, but the results sound extremely good. Its range is wide, distortion appears very low, and it will not mark even acetate microgrooves with repeated playings. Normal bass compensation should be used in the amplifier plus a roll-off from 1Kc to about 10 db at 10Kc for microgrooves.



Detailed drawing of counterweight.

If you are fortunate enough to have some of the all-sapphire rod stylii, these would be preferred to the metal shank type. Unfortunately the all-sapphire type appear to have been discontinued and are no longer available. They were useful in reducing the mass of the moving system due to their extremely low mass. However the metal type are generally made of duralumin which is appreciably lighter than steel.

The all-sapphire rods would of course require regrinding to a 1 mil point for microgroove records.

Tracking is important with microgroove, and fortunately the 12a with its long arm is quite good in this respect.

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

HOME-MADE MOVING COIL PICKUP PERFORMS WELL

Here's a project which will interest readers who have had ideas about constructing their own lightweight pickup. We are indebted for the article to Mr. R. Marshall of 60 Asling St., North Brighton, Victoria.

THE considerations which prompted Mr. Marshall's effort to construct lightweight pickup were the ecord wear caused by the average iddleweight pickup, the difficulty replacing treasured prewar pres-ngs, the high cost of a commercial nit and the amateur's urge to "roll s own."

Simple construction, economy of aterials and consistent performance ere reckoned to be more important an highly robust qualities, since he intention was to use the pickup refully at all times. Nevertheless, he finished job, during 12 months of egular use, has taken quite a few nocks without detrimental effect. The moving-coil principle was dopted and, with patience, rather an skill in the construction, a good b can be made.

The following points will give some dication of the results obtained, he voltage output is extremely low, millivolts but, when fed through 50/100,000 ohm transformer, an utput of approximately 80 millivolts as obtained across the secondary inding. Bass compensation is ecessary, as in other pickups perating on this principle. The ylus compliance is extremely high. or optimum results, a stylus vertical oint-pressure of 7 grams (¼oz) is commended.

The stylus rides comfortably in e 50cps groove of a test record, nning at half speed (25cps) with-ut developing arm resonance. Re-nance peaks are not discernible to e ear in the reproduction.

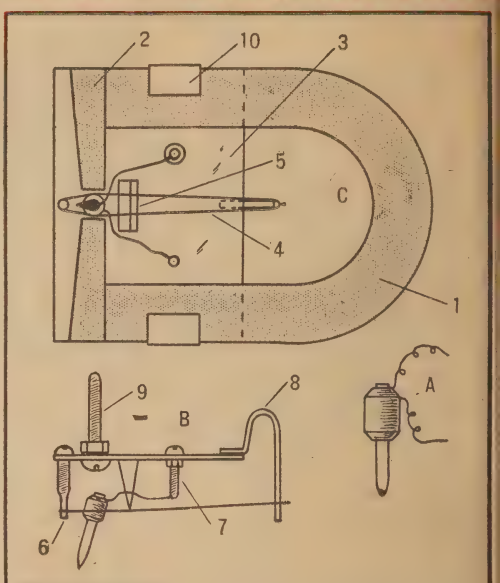
CONSTRUCTION

With the exception of the coil and e supporting loop, the general con-ruction of the complete unit can easily followed by referring to e sketches. General dimensions ve not been shown as these will be verned by the size of magnet ailable.

The design of a counter-balanced spring-loaded arm for the unit is ot critical, provided that its vertical nd horizontal movement is free om friction. The tracking error ould be as small as possible, par-cularly toward the centre of the cord.

The following steps are suggested the construction of the stylus coil ssembly.

(1) Clamp a small hand-drill rizontally in a vise.



The key to the diagram is as follows:— 1. permanent magnet—2. pole piece—3. base plate —4. suspension loop 5. Bridge—6. front loop support (⅛" brass bolt with thread filed down where loop passes around it)—7. terminal—8. rear loop support—9. pick-up mounting bolt (brass) — 10. U-clamps holding magnet.

★

(2) Insert a straight - shank sapphire - tipped stylus in the chuck leaving 3-8in protruding from jaws to stylus tip.

(3) Wind about 25ft of about 40 B&S enamelled wire (which may be removed from an old audio transformer) on to a small cotton-reel or similar bobbin, and secure the reel between two felt washers to a convenient point on table opposite the drill chuck by means of a woodscrew. It should be screwed down tightly enough to prevent it rotating freely, and yet not so tightly that the enamelled wire will break when withdrawing it from the reel during the winding of the moving coil.

(4) Secure the free end of the enamelled wire to the chuck with a piece of sticky paper, allowing about 2in for terminal connection, and by carefully rotating the drill, close-wind for a distance of 3-16in along the stylus shank. While keeping the tension on the wire, paint lightly with thinned down aeroplane cement or "Tarzan's Grip" and allow to dry. (About 10 minutes in a warm room.)

(5) Wind on the second layer and stop one turn from beginning of previous layer. Treat with cement as before.

(6) Continue carefully to layer-wind the coil until the diameter is 1-8in. Give the coil a finishing coat of cement and allow to dry HARD.

(7) Nip off wire, leaving about 2in for terminating and remove stylus from chuck. Nip off level with end of coil that portion of stylus which was held in chuck. The finished stylus-coil assembly should appear as per sketch A. The coil should have a DC resistance in the vicinity of 15 ohms, the exact value depending on the gauge of wire used.

Sketch B shows the front supporting pillar and the springy rear support fashioned from a steel bobby-pin and soldered to the brass base plate.

The loop, which is slightly shorter than the free distance between these supports is constructed thus:

(1) Remove the heads from two small nails and drive them into a piece of wood so that their distance apart is about 1-16in less than the free distance between the supports.

STYLUS SUPPORT

(2) Unwind the grid wire from a dud valve, carefully straighten and loop it around the nails and twist the free ends together, nipping the surplus wire off. A blob of cement, when dried HARD, will prevent the loop from untwisting when under tension.

(3) When ready, remove the loop and by pressing the rear support

forward, it may be placed in position. When the pressure is removed, the loop will be under tension by reason of the rear support tending to return to its original free position. The amount of tension is surprisingly enough, not critical, provided that it is sufficient to maintain the stylus in a vertical position on the record.

To mount the stylus coil assembly in the suspension loop, proceed as follows:

(1) Ease the coil into the loop and slide it along to a position where it will be between the pole pieces when these are secured in position.

(2) Ensure that the loop grips the coil midway along its length. See that the stylus is vertical when viewed from the front and sloping about 15 degrees in the direction of rotation of the record when viewed from the side.

(3) A blob of cement on each side of the coil where the loop wire passes over it will, when dried *hard*, secure the coil firmly to the supporting loop.

(4) An inverted V-shaped bridge piece is bent from a small rectangle of thin brass or aluminium and slipped under the loop fairly close to the coil. Its position is not critical.

SOLDER CONNECTIONS

(5) Carefully bare the terminating ends of the coil and solder the inner (starting) end to the uninsulated terminal, and the outer (finishing) end to the insulated terminal. The unit should now appear (side view) as per sketch B.

(6) The pole pieces are filed to shape from a piece of soft iron or mild steel, drilled or tapped for 1-8in brass round head screws, and screwed to base plate after placing a blob of pure petroleum jelly on the pole faces. They should be positioned as close to the coil as possible but without preventing the coil assembly from rocking freely. Any surplus petroleum jelly which may be squeezed out of the gap should be carefully removed.

The permanent magnet should now be slid into position and secured to the base plate with small clips bent from thin sheet brass. The completed head should now appear, in plan view, as per sketch C.

USE GOOD MAGNET

The voltage output from the pick-up is directly related to the strength of the field of the permanent magnet, so bear this in mind when selecting the magnet.

A further point to remember is that the magnet will have an attraction to a steel turntable and for this reason the check of the stylus tip pressure should be done with the pickup head in the playing position on the turntable.

The degree of bass compensation will depend to some extent upon the acoustic characteristics of the room in which the set-up is used. The simple compensation pad used by our contributor across the secondary winding of the pickup transformer consisted of a series arrangement from the "hot" side of the winding to earth of a .1 megohm resistor, a .02 mfd capacitor and a .2 megohm resistor with the grid of the first valve in the amplifier taken to the junction of the .1 meg. and the .02 mfd.

WHICH RECORD SPEED IS BEST?

(Continued from Page 47).

controlled, and noisy results will be obtained. These points will be clear from an inspection of Fig 10.

Apart from this noise, a needle with a tip of radius 0.002in, playing a microgroove record, will give four times the tracing distortion of the standard (0.001in radius) microgroove needle.

An elliptical cross-section point with a small radius of curvature at the contact edge would reduce the distortion, but with a principal radius of 0.002in would contact the microgroove at the shoulder, which is not desirable.

I would like to thank Mr. R. E. Spencer for collaboration in its preparation.

ANCIENT SHOCK TREATMENT

ELECTROSHOCK treatment, modern method of treating some patients with mental sickness, was used by physicians of ancient Rome, Dr. John Fulton, professor of the history of medicine at Yale University, reports.

For the electricity, the Roman physician, Scribonius Largus, used the discharge of an electric fish, the Torpedo. He delivered the shock to the head for the relief of headache and also to lessen the pain in childbirth.

TRADE REVIEWS AND RELEASES

ELECTRONIC DICTATION MACHINE

We have recently had the opportunity of checking and testing the "Emidicta," an electronic office dictation machine distributed in Australia by E.M.I. Sales and Service Ltd. Designated as "Model 2400," it offers all the facilities required from this type of machine.

THE Emidicta uses the magnetic recording principle but applied to a paper disc rather than to the more familiar tape or wire.

The discs, which are comparatively cheap, are placed on a turntable and held firmly in position by a second moulded disc, attached to an arm, which swings down on top of them. This moulded disc carries a spiral groove which engages a toothed wheel under one edge of the magnetic head assembly.

The outer edge of the assembly rests on the magnetic head proper which is in contact with the surface of the paper disc. As the turntable rotates, the assembly is gradually drawn from outside to inside and describes a spiral magnetised track on the paper disc.

A special feature is that the disc carrying the dictated message can be folded and mailed in an ordinary foolscap envelope, to be played back on a similar machine anywhere else in the world.

For normal dictation, the executive plugs a hand microphone into the unit, sets the controls for "dictate" and presses a lever on the side of the microphone. This causes the turntable to rotate, the table stopping immediately pressure on the lever is released. Use of this "press-to-talk" feature eliminates waste of recording time during pauses, &c.

For checking purposes, the same microphone serves as an earpiece and words or sentences can be re-recorded, the original being deleted automatically.

For transcribing, the typiste may use either the special lightweight headphones or the built-in speaker. A clip-on attachment to the typewriter carries a stop-start button and a repeat button, which are operated by the typiste's thumbs in exactly the same fashion as the space-bar.

Each disc carries six minutes of continuous recording and after use can be wiped clean with a permanent magnet erase bar. Life of the discs is almost indefinite. A time scale on the machine and a chit pad can be used, if required to identify letters and typing method.

Details of the Emidicta can be obtained on application to E.M.I. Sales and Service, NSW Pty. Ltd., or R. B. Wyper Pty. Ltd., Sydney.

Price of the unit complete for dictating and transcribing is £139/16/-.

THREE SPEED RECORD CHANGER

British Merchandising Pty. Ltd. announce a new multi-speed record changer designed to handle standard and long-playing records at either 78, 45 or 33 1-3 rpm.

THE units use a microcell crystal pickup fitted with two stylii having .001in and .025in radius for LP and standard recordings respectively.

The required stylus is selected with a small control on the pickup head and this is color-coded to match the markings on the speed selection knob, thus reducing the possibility of the wrong stylus being selected.

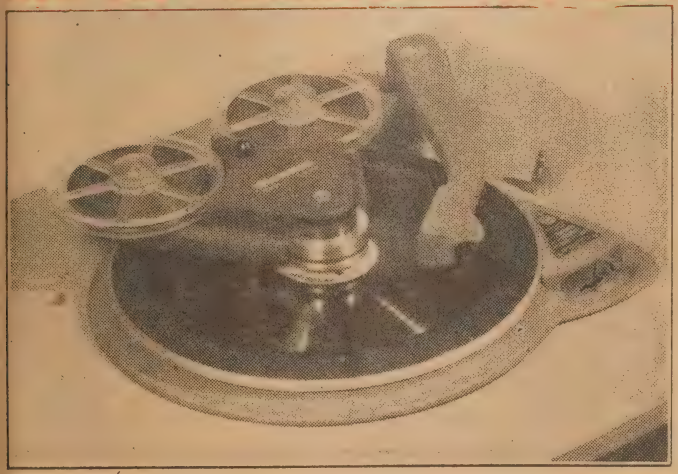
The need to adjust the counterweight for each type of record has been overcome in this unit by fixing the weight at approximately 11 grams. The makers claim that no tracking difficulties are experienced and they consider that this weight is an effective compromise.

The changer will play up to 10 records in one cycle, and at 78 and 33 1-3 rpm 10in and 12in records may be mixed, and when set to 45 rpm the changer operates on the normal 7in diameter.

The whole unit is mounted on a rigid diecast base, and the turntable has been designed with the view to providing a true surface free from warping or irregularities of any kind, while felt insets are used to minimise the effects of turntable resonance.

Retail price, including, sales tax, is £36/12/6.

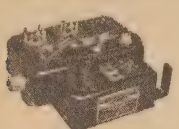
NEW BRS "MAGNOFILM" TAPE DECK



Latest product of Messrs. Byer Industries Pty. Ltd., is the "Magnofilm" tape deck, which is intended as a simple, low priced unit for professional use. It is intended to attach as shown to studio turntables, deriving therefrom a drive which is naturally free from wow and flutte effects. Capstans will be made available to allow a tape speed of 7½ or 15ins per sec. with turntable speeds of either 33 or 78 rpm. The deck lifts easily out o the way. With the aid of a sma" adapter unit its output can be fed directly into normal program channels. A simplified version for domestic use is also planned.

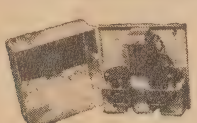
RADIO CONTROL BOX BC 451A

Ex U.S. Army. Parts are:—
1 SP Push Button, 2 SP Toggle Switches; 1—4 position Semi Rotary Switch and 1—3 position Semi Rotary Switch; 2—Phone Jacks.
All fitted into neat black-crackle finished box, easily worth 25/-. Our price, **7/6 each.**



CONTROL UNIT

CZR-23ABG combined with Selector Unit CZB-23ABH, ex U.S. Navy equipment.
Parts used are a 6 position wafer switch, 2-SP Cutler Hammer Switches, a phone Jack and 5 pin Plug and Socket and a 7 pin Plug and Socket, housed in two neat black crackled boxes mounted on unit plate. Value at least 15/-. Our price, **5/-.**



INTERPHONE AMPLIFIER

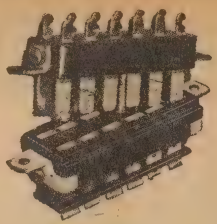
Ex-U.S. Army B.C. 21 2D.
Has two audio coupling transformers, 4 resistors, 1 condenser, two valve sockets, uses two 6C5 valves in neat aluminium box with 6 pin connector plug and socket. Price without valves, **8/6 ea.**

SWITCHES

Special Line of Semi Rotary
Switches suitable for voltages up to 240 volts, ideal for switching any type of radio, etc., has ¼" Shaft to suit Standard size radio knobs. Single hole mounting, easily worth 4/6, our price **1/9** ea.

Single Pole Toggle Switch
In solid bakelite with Nickel-plated toggle for low voltage work (up to 32 volts), very robustly constructed. Easily worth 3/6, our price, **1/9 each.**

Dual Ignition Switches
as used in Aircraft—A good pair of Switches for heavy duty, low voltage work (up to 32 volts). Worth 7/6, our price, **3/6 each.**



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8 pin	5/6
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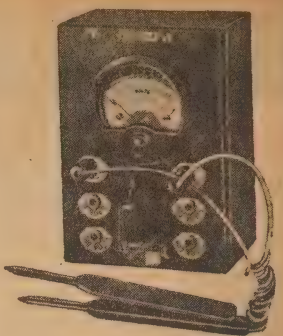
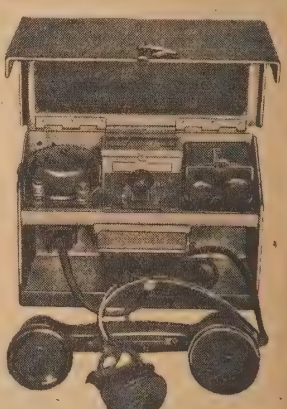


CHIEFTAIN MULTIMETER

The ideal pocket size meter for measuring voltages of electrical circuits and checking continuity of circuits, etc. Volts scales 0-15, 0-150, 0-300, 0-600, D.C., OHMS scale. 0-50,000. The cheapest and smallest on the market. Complete with prods and battery. Can be carried in your coat pocket with ease. Price, **£3/9/6.**



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EXPOSURE METERS—OLD AND NEW

The matter of exposure and exposure guides is of vital importance to photographic enthusiasts. Our discussion this month centres around this subject and a suggestion is made regarding the mounting and use of the exposure charts featured in the last issue.

THE assembly is built around the press fastener mentioned in last month's article, but is modified to eliminate the disadvantage we mentioned, namely, that there was too great a distance between the centre disc and the body of the calculator.

First some details about the fastener. It is a type sometimes called a "commonsense fastener," and is intended to fasten together two pieces of cloth, such as sections of a car cover, the front of a pair of overalls, &c. We obtained ours from a motor supply house, and we believe they are made by the Carr Fastener Co., though no doubt similar devices are marketed by other firms.

As purchased, the device consists of four parts, making two pairs, each of which is intended to be riveted together with the material between. These are shown on the left in the accompanying sketch labelled A, B, C, and D. A and B normally form one pair and C and D the other. When made up, the sections B and C are pressed together and hold quite firmly, though they may be rotated freely.

FITTING FASTENER

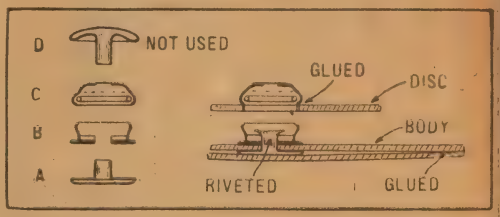
After the diagrams have been pasted on card and allowed to dry thoroughly you can commence fitting the fastener. For the body of the calculator you will require parts A and B. A being passed through a hole in the exact centre, as marked, B slipped over it, and the two riveted together. The general arrangement is as shown on the right of the sketch.

At this stage the cardboard mount will probably show some tendency to curl, due to the action of the paste. In the case of the body section this is overcome by pasting a second piece of cardboard on the back, making a double thickness. This not only eliminates the curl but makes a much more robust job and provides a smooth surface on which to mount the light tables, &c.

To remove the curl from the disc, moisten the back slightly and allow to dry under pressure, such as a flat iron or a couple of heavy books. When completely dry and flat, cut a hole in the centre just large enough to pass over the section B, and then glue the section C of the fastener to the face of the disc as shown in the sketch.

ACETATE GLUE

About the best type of glue for a metal-to-paper joint is one of the acetate variety, and in our case we borrowed a bottle of colorless nail polish from one of our typists. We had some misgivings at first as to whether such a joint would be strong enough to stand up to normal usage, but after subjecting it to a fair amount of use, and some abuse, it appears to be quite satisfactory.



This diagram will give you some idea of the design of the fastener as well as showing how it is fitted.

It is important that the section C be accurately centred on the disc, and it is worthwhile going to a little trouble to ensure this. Some may prefer to glue the pieces together before cutting the hole, and this will allow the centre mark to be used for alignment. However, the cutting of the hole afterwards is rather tricky, but it can be done with the corner of a sharp razor blade. In any case, no work should be attempted on the disc until the glue is quite dry and it should preferably be allowed to stand overnight.

The final step is simply to snap the two sections together, and once this is done it is not desirable that they be taken apart again. If they have to be separated it can be done by forcing the blade of a screwdriver between the metal sections, but there is the risk that the cardboard may be damaged.

The light tables, &c., may be fixed to the back either by glueing or with strips of Durex tape along each side. The latter arrangement will probably be the best, as paste has some undesirable effects on this type of paper. If you use Durex it is just as well to have someone stand by to hold the various pieces in place until they are stuck down, otherwise you can get things into something of a tangle.

The finished job will be a self-contained unit which is easy to carry and contains all the information you should require for outdoor work.

by Philip Watson

While on the subject of exposure it might be interesting to investigate other methods of calculating this rather elusive factor.

One of the first arose in the very early days of photography when the most popular type of printing paper was what was known as POP (Printing Out Paper). This was a paper which produced an image without the need for chemical processing, it merely being necessary to load a frame with a negative and a sheet of paper and place it in the sun. The action of the light would darken the paper according to the transmission of the negative and, when sufficiently exposed, the image was fixed with hypo or a combination of hypo and toning bath.

Early workers found that the length of time taken for a piece of this paper to darken to a standard tint was a good indication of the strength of the prevailing light, and many commercial exposure meters were marketed using this principle.

They usually consisted of a tinted plate which represented the standard color and which had a hole in the centre through which the sensitive paper was visible. This made it easy to match the two colors when the paper was exposed to light, and the time taken to achieve this match was noted.

This, then, became the equivalent of a light value and was transferred to a set of scales similar to our own exposure guide, and from which the exposure time could be calculated. Provision was usually made to accommodate a strip or disc of paper large enough for several dozen exposures, and also to move a fresh area of paper into position when required.

FOR AND AGAINST

The main advantage of the scheme was low cost plus the fact that it did actually measure the light, as distinct from light tables, which assume that there will be a certain amount of light under certain conditions. This was offset to a large extent by the low sensitivity of the paper, which meant that the device was most efficient under those conditions which are easiest to judge, i.e., bright sunlight.

As the light became weaker the length of time taken to darken the paper became disproportionally longer, until eventually, for all practical purposes, it failed to act at all. This was usually under weak daylight or artificial light conditions, so that the device failed where it was really most needed.

Another disadvantage was the need to time the action of the paper, which

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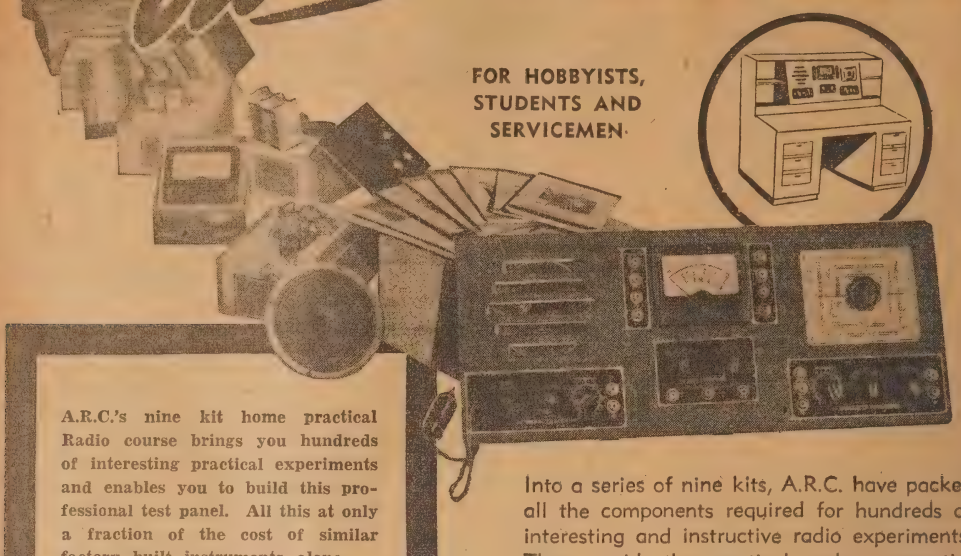

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meant that a watch had to be carried and, further, that in poor light a considerable time had to elapse before the exposure could be calculated. Maybe it was not so important in the leisurely days of a generation ago, but the modern photographer would often be hard put to it to use such a device and still keep pace with his subject.

The next step was the extinction type meter which was aimed at overcoming some of the disadvantages of the sensitive paper type, particularly the inefficiency at low light levels. This meter was also a commercial version of a custom popular with photographers in the days when plate cameras, ground glass screens, and black clothes were standard equipment.

These workers found that the brilliance of the image on the ground glass could be taken as an indication of light value, and common practice was to close the diaphragm until the image vanished and then transfer the diaphragm setting to a set of tables which would indicate the exposure.

CARE NEEDED

Quite a number of precautions had to be observed to ensure that the readings were always taken under reasonably standard conditions, such as preventing stray light from reaching the ground glass, always observing the same set of conditions on the glass, and not allowing the eyes too long a period under the cloth with consequent confusion due to their natural accommodation.

In spite of these difficulties the scheme was very popular, particularly for indoor work where it was considerably better than a wild guess, which was about the only other alternative. It is probably this fact, i.e., that it was usually used under similar conditions, which enabled a fairly high percentage of successes to be obtained, for the scheme is not satisfactory over a wide range of light conditions due to the natural accommodation of the eye.

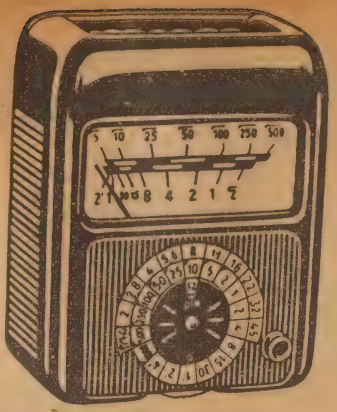
Quite obviously this system was rather cumbersome and time consuming, so that commercial units were evolved to do a similar job quicker and easier.

One of these consisted of a tube three or four inches long and about three-quarters in diameter, into one end of which the operator looked while pointing the other end toward the subject. A simple lense enabled the eye to be focused on a ground glass screen about half way down the tube, and on which was printed a letter or figure. In front of the ground glass was a diaphragm, and in use, this was adjusted until the figure either vanished or was just visible according to the maker's instructions.

LIGHT VALUE

The setting of the diaphragm was taken as a light value and a series of engraved rings on the body of the device could be set to indicate the correct exposure. Because of the accommodation of the eye it was usual to provide a number of rough settings corresponding to such conditions as strong outdoor light, weak outdoor light, indoors, and artificial light, and the appropriate one would have to be selected before any readings were taken.

A more modern version of the device is much more compact and dispenses with the diaphragm by providing a row of figures, usually from one to nine, each having a



A typical modern photo-electric exposure meter.

greater density than the preceeding one. Thus it is direct reading in the sense that it is only necessary to view the row of figures and select the highest which may be clearly read. This then becomes the light value and some form of adjustable scale converts it to exposure time.

While the accommodation of the eye must impose limitations on devices of this kind they still enjoy a certain amount of popularity, there being at least two makes available on the Australian market. Their suitability for use in weak light is still one of their most attractive features, while their cost is only a fraction of that of a photo-electric type.

The photo-electric meter is the product of comparatively modern times and is generally considered to be the most accurate device of its kind to date. While this is in the main true it cannot be regarded as the foolproof device which popular opinion would sometimes have us believe, and it can be shown that used incorrectly it has no greater accuracy, if as great, as a simple chart.

While details vary from make to make, the basic principle is generally the same, consisting of a light sensitive cell of the generating type and a sensitive movinng coil meter. Because of the low output from the cell the sensitivity of the meter must be high, generally in the order of 100 microamps, and this means high cost and delicate construction.

As with all other types it is necessary to provide an adjustable scale to convert the reading on the meter to actual exposure figures, and this is invariably incorporated on the body of the instrument. In some types a second pointer is located above the meter pointer and coupled to the calculating scale. When the second pointer is made to coincide with that of the meter the exposure is automatically calculated, the scales having been pre-set for the correct film speed.

However, having found a method of measuring light we are now faced with the problem of just what light to measure. Shall we measure that falling on the subject (incident light) or that reflected from it?

There are adherents to both these schemes and it is interesting to note that of the two devices already described, the first used incident light and the second reflected light. In the case of the photo-electric meter designed to read reflected light, the meter is pointed at the subject from the camera position, and at first glance it may appear that this is all that is necessary since it will measure the light actually reaching the camera and allow for all factors including the type of subject.

However this is not really a true picture of what happens. The light value read in this way is an average of all the individual reflections within the pick-up area. Now we are not so much interested in the average amount of light as we are in the light from the darkest part of the subject, for this is always the most important factor in assessing exposure.

POSSIBLE ERRORS

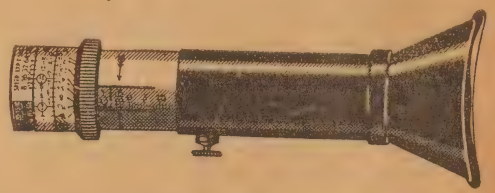
If the meter is adjusted to give a correct exposure for an average subject (if there is such a thing) it may indicate under-exposure if we introduce a light-colored object into the picture. An example may help to clarify this: Assume we measure the light reflected from two people in dark clothing against a medium background and calculate an exposure on this basis. Two more people now join the group, but they are dressed in white shirts and flannels so that the amount of light reaching the meter is increased and a second exposure will be calculated as less than the first.

But should the exposure be less because of the presence of the two in light clothing?

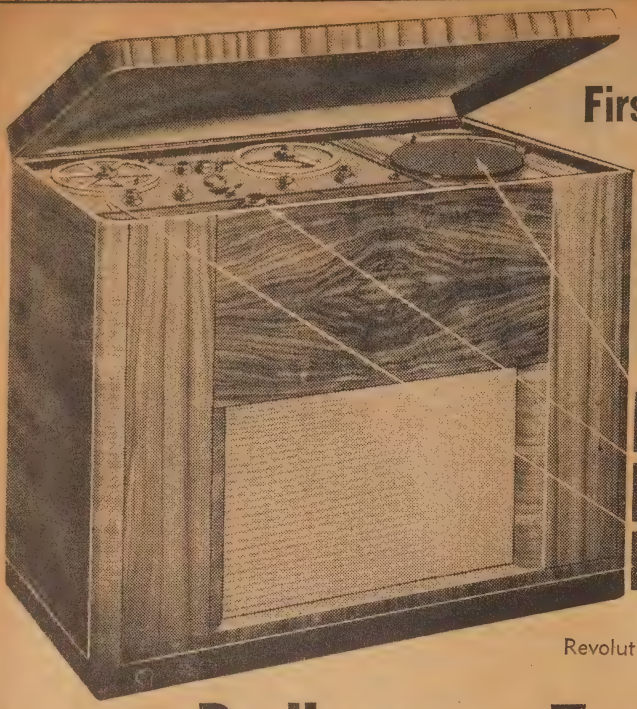
The answer is most definitely no, for the primary requirement of exposing for the darker portions still remains, and is not affected in the slightest by the presence of a lighter object. It may be argued that there is a risk of over-exposing the light object unless the exposure is decreased, but this is not so because the latitude of the film is more than sufficient to handle a subject of this nature.

The correct method is to measure the light reflected from the darkest object, by taking a close-up reading and base the exposure on this, but such a procedure is not always possible and, even when it is, it is seldom followed. This is no doubt due to popular misconception which credits these devices with some magical powers, such that they only need

(Continued on Page 93)



An old type extinction meter. The light is judged by looking into the eyecup on the left and the calculating rings are on the right.



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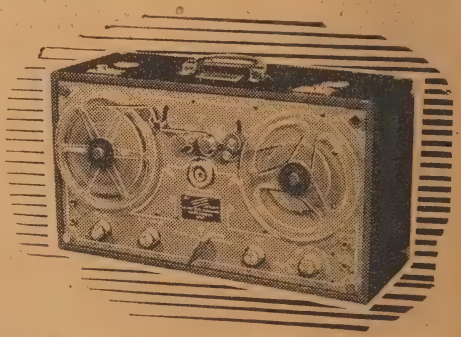

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A COURSE IN TELEVISION

(Continued from Page 61)

Resistor R4, marked "hor. peaking," is part of a regenerative feedback circuit from the transformer secondary to the grid of the 6BG6-G. It serves to accentuate the negative peak, steepening the return pulses and varying the pulse width. Details of the circuit and its final adjustment are closely linked with the exact pulse shape supplied by the sweep oscillator. It must also be set having due respect to its effect on the plate current of the 6BG6-G.

As a matter of interest, figure 2 also shows details of the vertical deflection amplifier, its comparative simplicity being apparent.

Both vertical and horizontal shift are accomplished by passing a suitable amount of current through the respective deflection circuits, the relevant controls being R19 and R11.

The final point is to examine the operation of the EHT circuit, which involves two separate rectifiers and two filament windings on transformer T1.

Because the pulse voltage applied to the high-voltage rectifier tubes is unidirectional an unconventional voltage-doubling circuit is required as shown in figure 2. Operation of this circuit is illustrated in figure 3.

During the retrace period when the high-voltage pulse is applied, V1 conducts and C7 is charged with the polarity indicated. At the beginning of the scanning interval the plate voltage on V1 goes negative and remains negative throughout the scanning interval. V1 is maintained at cutoff while C7 discharges through R8 to charge C10 and at the same time discharges in series with C11 to supply the load current.

As the voltage across C7 and C11 decreases the voltage across C10 increases. During subsequent retrace periods the voltage across C10, together with the pulse voltage, opposes the voltage across C7 and is sufficient to cause V2 to conduct and to charge C11.

OPERATION

Operation of the circuit may be summarised as follows: During retrace C7 charges from the source and C11 charges from C10. During the scanning period C10 charges from C7 through R8. The load current is supplied by C7 and C11 is series.

For the normal kinescope load current the output voltage of the circuit is approximately 1.8 times the peak input voltage to the rectifier system. A further increase in voltage is obtained by returning C1 to the low-voltage secondary of the transformer to add a portion of the negative voltage pulse appearing there.

The regulation characteristic of the high-voltage supply is given in figure 4. Although the plate-current characteristic of the 6BG6-G will determine both the maximum high voltage and the maximum deflection power output, the no-load voltage for an average tube is, as indicated on the curve, 13.5 kilovolts.

With a load current of 200 microamperes the average drop below the no-load voltage is 2 kilovolts. Regulation is also effected by the value of the resistor (R8) in the voltage-doubler circuit.

The 500,000-ohm series limiting resistor (R9) is used to remove the capacitive loading effects of the kinescope high-voltage lead.

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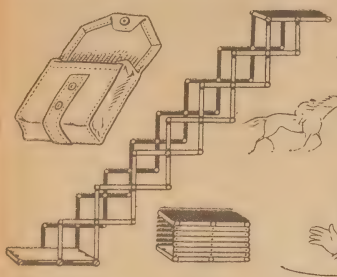

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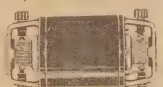

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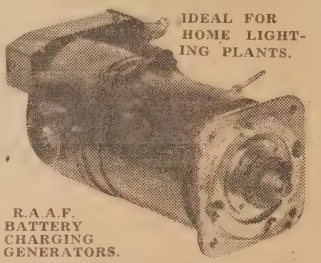

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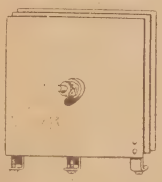

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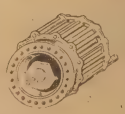

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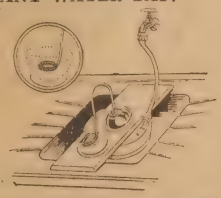

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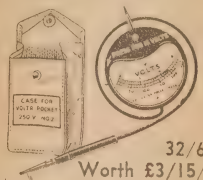

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SHORT WAVE NOTES BY RAY SIMPSON

BRITISH SERVICE IN FAR EAST

The British Far Eastern Broadcasting Service have brought a new schedule into use which came into operation on 22nd July. Thanks to Graham Hutchins' DX Session over Radio Australia we are able to give their new operating times and frequencies.

THE 13-metre band outlet on 21.72 mc has been dropped from all sessions. Programs formerly broadcast on 21.72 mc will move to 17.755 mc, those on 17.775 mc will move to 15.3 mc, the 15.3 mc programs change to 11.955 mc, and, finally, the 11.955 mc broadcast is now on 9.68 mc. 7.15 pm to 9.30 pm to NSE China, Japan and Indo-China; 11.0 pm to 2.30 am to India, Pakistan and Ceylon on 17.755 mc. 7.15 pm to 12.15 am, 12.30 am to 3.30 am and 3.45 am to 4.30 am on 15.3 mc (Targets as for 17.755 mc).

9.45 pm to 10.45 pm to NSE China, Japan and Indo-China; 11.10 pm to 2.30 am to Burma and Thailand on 11.955 mc. 7.15 pm to 9.15 pm to Malaya and Indonesia; 9.30 pm to 10.45 pm to NSE China, Japan, Indo-China on 9.69 mc.

9.30 pm to 10.0 pm, 10.30 pm to 10.45 pm to NSE China, &c; 10.0 pm to 10.30 pm, 11.0 to 2.30 am to Malaya and Indonesia on 7.12 mc; 7.15 pm to 9.15 pm to Malaya and Indonesia on 6.175 mc.

READERS' LETTERS

As we have mentioned previously, we are always very glad to receive reports from listeners as to what they have been hearing as sometimes one of them may come across a station which is not generally heard at other locations.

During this past month we have had very interesting letters from Mr. M. McShane, of Birchgrove, NSW, who sent along a very comprehensive list of the various stations he had heard. Another informative letter was received from Mr. A. Talbert, of St. Kilda, Vic., enclosing verifications for our inspection. Finally there was a letter from Master H. Stevenson, of New Farm, Q'ld., which gave details of his receiving equipment and a nice list of stations he had heard recently. Many thanks to you all for the help given.

SOME NEW STATION VERIFICATIONS

FHE3, SENEGAL.—Mr. Talbert, of St. Kilda, Vic., has kindly sent along a verification card he recently received from FHE3, Dakar, Senegal. The card is printed in blue, yellow, red and black and shows a map of Africa with French Occidental Africa shown in red and the position of Dakar indicated in black. On the reverse side there is information about the station which states that Radio Dakar transmits from 5.0 am to 7.0 am on 11.885 mc and from 5.0 am till 5.15 am on 15.346 mc. Actually their information is a little confusing and it is possible that they are also on 15.346 mc from 5.0 am to 7.0 am. French was never our strong language so we may have interpreted it incorrectly.

4VEH, HAITI.—We remember some months ago when Station 4VEH verified our report on their transmission they said they would send along their verification card as soon as they were printed. They kept their promise as we have just received the card which is of the glossy photograph type showing a view of the station's masts at the right hand side and to the left it reads, East and West Indie Bible Mission, Confirming with thanks your reception of radio station 4VEH on 9884 kc, June 18, 1950, Box 1, Cap Haitien, Haiti.

As mentioned elsewhere they also sent along their current schedule of transmissions. The letter came by air mail with three very colorful stamps on the envelope.

ZFY, BRITISH GUIANA.—Although the above verification has not been viewed by the writer we think readers will be interested in the details as given by John Oskay in the Universalite. He says their card shows "ZFY Radio Demarara" and gives the following information: 6000 kc 600 watts (shortly 2000 watts), 1230 kc 250 watts (shortly 500 watts). Sunday 8.45 pm to 2.45 am Monday; Week-days 8.15 pm to 2.45 am and 5.45 am to 11.45 am.

Their address is The British Guiana Broadcasting Company Ltd., Georgetown, British Guiana. We know that some local listeners have verified this station but despite three reports over a period we have been unable to collect one. Incidentally Mr. Oskay sent three reports over a period of three years before he was successful.

SHORT Wave Notes for the October issue are due on September 8. For the November issue they are due on October 6. Please send them direct to Mr. Ray Simpson, 80 Wilga St., Concord West, NSW.

STATION ADDRESSES

CXA19—Radio El Espectador, Difusoras del Uruguay, 18 de Julio 1393, Montevideo, Uruguay.

CXA21—Radio Fenix, Rio Branco 1366, Montevideo, Uruguay.

YVKM — Radio Continente, Apartado 866, Caracas, Venezuela.

YVKF — Ondas Populares, Apartado de Correos 587, Caracas, Venezuela.

ZPA3 — Radio Teleco, Calle Azara 56, Asuncion, Paraguay.

ZPA5 — Radio Encarnacion, Compania Paraguaya de Radio difusion, Encarnacion, Paraguay.

HORT—Radio Balboa, Avenida Ecuador 9, Panama City, Panama.

HOLA—Radio Atlantico, Apartado 444, Colon, Panama.

NEW STATION LOGGINGS

Call	Kc	Metres	Location	Time Heard
ZYZ21	4905	61.18	Rio de Janeiro, Brazil	—
FZP8	6135	48.90	Papeete, Tahiti	3.30 pm
Hollandia	7170	41.84	Hollandia, New Guinea	9.00 pm
Conakry	7548	39.75	Conakry, French Guiana	2.00 am
Conakry	10230	29.30	Conakry, French Guiana	2.00 am
CE1190	11938	25.13	Valparaiso, Chile	9.30 pm
V3USE	12120	24.75	Port Louis, Mauritius	2.00 am
Chad	15596	19.24	Chad, Fr. Equat. Africa	4.00 pm

FLASHES FROM EVERYWHERE

TAHITI: After being one of the most difficult stations to receive in Australia, Papeete has now often been logged on 12.08 mc and on a few occasions around 9.0 mc. Latest advice from Arthur Cushen to Radio Australia tells us that Radio Tahiti is now on the air daily from 2.30 pm to 4.30 pm, using 6.135 mc.

There is a program in English on Thursdays from 3.0 pm to 3.25 pm which includes news on shipping, weather, air flights and special events, such as dances, &c. On closing they give the following announcement: "This is Radio Tahiti in the 48-metre band will be on again next Wednesday evening at 7.0 pm with a further program in English." At time of writing we have not yet heard this transmission on 6.135 mc.

INDO-CHINA: There has been quite an amount of interest in the French lesson broadcasts from Radio France Asie in Saigon and from Mr. Michael Randal we learn that these lessons can be heard each Tuesday and Friday from 8.15 pm to 8.30 pm on 11.83 mc. These broadcasts can also be heard on the same days at 11.0 pm on 11.78 mc and we understand that if you write to the station they will send you a booklet which covers the lessons.

The station also advises that they are carrying out test transmissions on 9.748 mc in parallel with 9.524 mc directed to Europe at 8.30 am and directed to India on 9.754 mc and 11.83 mc at 11.30 am. News in English is given at the above times. Since before the war this station has always been very popular with Australian listeners.

HAITI: The well-known Haitien station 4VEH, which is located in Cap Haitien, has sent along their schedule of programs from which it will be noticed that they operate on both 9.75 mc and at other times on 9.756 mc. Their English programs are as follow: Missionary Hour, Wednesday 9.15 pm to 11.0 pm, 9.75 mc; Evangelic Hour, Sunday 10.30 pm to 11.30 pm, 9.75 mc; Light and Life, Monday 11.30 am to noon, 9.756 mc; Harding College Hour, each weekday 11.0 pm to 11.15 pm, 9.75 mc; Harding College Hour Sunday 10.0 am to 10.15 am, 9.75 mc. Spanish programs are the Lutheran Hour, Thursday 10.15 pm to 10.30 pm, 9.75 mc; Monday 11.15 am to 11.30 am, 9.756 mc; Calvary Hour, Tuesday 10.30 pm to 11.0 pm, 9.75 mc; Good News, Mon., Wed., Thurs., Fri., Sat. 10.30 pm to 11.0 pm, 9.75 mc; Sunday 10.0 pm to 10.30 pm, 9.75 mc.

TANGIER.—From a recent copy of the Universalite we gain some information regarding Pan-American Radio in Tangier. In a letter to an American listener the station said that they were at the moment in the process of altering their antenna and also were shortly to instal new transmitters.

At the present time they are on the air from 11.0 pm to 11.30 pm operating on 15.048 mc. They open their program with an announcement and then transmit a non-stop musical program. Their address is Pan-American Broadcasting System, The International Banking Corporation of Tangier, Boulevard Pastor 39, Tangier, Africa, International Zone, Morocco. Rather a long address but we suppose it is better to show it all rather than have the letter returned owing to insufficient address.

BRAZIL.—We are indebted to the DX session from Radio Australia for details of a new standard time service being given from Rio de Janeiro. This service will be provided by station ZYZ21 operating on 4.905 mc using a power of 1 kw. It will transmit correct time every minute throughout the 24 hours.

The address of this new station is Station ZYZ21, Avenida Presidente Vargas 417A, 22 Andar, Rio de Janeiro, Brazil. From the same source we learn that Radio Tupi is still on 15.364 mc but will probably return to 15.37 mc after completion of new oscillator stage now under construction. This station will not verify listeners' reports unless I.R.C. is sent.

THE HAM BANDS WITH BILL MOORE

In an endeavor to assist the communication position during floods on the North Coast the NSW Police Department is sponsoring a scheme by which amateurs could operate on police frequencies close to amateur bands when the occasion arose.

AT a conference of all interested parties held last year, it was decided that the police would be the responsible authority for the origination of all messages requesting relief, food, supplies, and the issuing of flood warnings.

This arrangement should eliminate any possible duplication of messages previously experienced. It is the most serious problem encountered in the US where similar requests for assistance from different authorities in the one area are common.

In view of the fact that amateur radio is only a hobby and that some amateurs in flooded areas will be busy on their own jobs during emergencies, the Police Department does not propose to nominate any specific amateurs for operation on the police frequencies.

CRYSTALS

The department will make available crystals for two frequencies 6915 and 3245 Kc and such crystals will be held by the local police in those areas likely to be affected by floods and when emergencies arise will be released to amateurs who are in a position to operate.

Messages handled on the channels will be primarily those originated by the police. Crystal controlled transmissions are necessary because base receivers are crystal locked and remotely operated.

Sergeant Bert Glasscock, VK2ZI, has fully investigated the position and as officer-in-charge of the NSW Police Wireless Section has a complete file of amateurs likely to be of assistance.

Even if the scheme comes into being there should be still plenty of traffic to be handled on the normal amateur emergency frequencies of 3501 and 7002 Kc, where messages for other authorities would be handled.

It has been decided by the authorities that National Station 2NR, in view of its wide coverage, will be used for the broadcasting of flood warnings and a link between the police net and 2NR would be necessary should other communications fail.

VKG3, Newcastle Police, and VKG main police station at Sydney, would be operating on 3245 and 6915 Kc should the occasion arise and the Army and RAAF have also promised to use these frequencies for liaison.

The whole scheme is still under review but final decisions should be made shortly and will provide another method by which amateur radio can assist.

CONTESTS

Don't forget the Jubilee Relay running through September—publicity given by the messages will assist in making of VK-ZL DX contest a success. Log sheets and rules have been forwarded through WIA Divisions and NZART sections, sufficient in number to cover all licensed amateurs. Most organisations will be posting them direct.

As you are by this undoubtedly aware, these contests have been officially recognised by the Commonwealth Government as part of the Jubilee Celebrations. The efforts of Mr. Allen Fairhall, MHR, VK2KB, made it possible and the Institute is fortunate in having a champion of amateur radio as a member of the Government. The recognition of the VK-ZL DX contest as part of the Jubilee Celebrations, has been followed by grant of £250 from the Commonwealth Jubilee Celebrations committee for trophies and publicity.

Every effort has been made by the contest committee comprising Jim Corbin VK2YC, Gordon Cole VK2DI, Morrie Meyers VK2VN, Vaughan Wilson VK2VW, John Moyle VK2JU, Ray Priddle VK2RA under the chairmanship of Wal Ryan VK2TI, to publicise the contest throughout the world.

Over 150 countries have been circularised, prominent DX men too, so there should be no shortage of DX stations on the air during October.

Phone men are especially requested to be active in the Jubilee Relay, as reception by short-wave listeners will give added publicity to Australia's Jubilee. Logs for the Jubilee Relay are due at Box 1734, GPO, Sydney, not later than October 30, 1951.

The VK-ZL DX contest takes place during the 2nd and 3rd weekends in October. The first weekend comprising the CW section the second telephony. Attractive trophies will be provided for the outright winners whilst high scoring stations in each State will receive awards.

The Ross Hull Memorial VHF Contest will take place on the 50-54 mc band during December and full rules will appear in the December issue of Amateur Radio.

ROTARY BEAMS

Rotary Beams, or better known in this State as "Rotary bird perches" named so by Joe Reed VK2JR, due to a pet aversion to them are in the news throughout the world. The reason is not due to their effectiveness as a means of directing signals, but to the reaction of the general public to their effect on the skyline.

In both the US and England a considerable amount of litigation has been and is proceeding on whether beams and their supporting towers are a normal adjunct to a home. Most of the opposition has originated from neighbors who object to these structures.

In fact, in Great Britain no antenna system can be erected before its effect on surrounding properties is considered, and all appeals to higher authorities on behalf of amateurs wishing to erect beam systems were rejected.

In the US however, one case was taken to the Supreme Court of New Jersey and a decision was given in favor of erecting a 60ft tower for a beam, despite a covering 35ft restriction in the area.

This case, that of W2UWK attracted considerable interest, and the ARRL General Counsel presented the case to the court on his behalf. Several other cases have yet to be heard in other States.

The tendency throughout the world is to tighten local government regulations. The decision of the New Jersey Supreme Court in effect deemed that the operation of an amateur radio station is a customary incidental use of residential property and ordinances hindering such operation are illegal.

Here in Australia to date, there has been little local opposition to the erection of amateur antennas. One case recently however resulted in an amateur having to dismantle his tower.

Jack Ferguson, VK2FJ, of Bronte, some time ago acquired a 50ft fabricated steel tower and proceeded to erect same.

The whole job was properly constructed, a qualified engineer designed the footings. On completion VK2FJ was ordered by the Waverley Council to dismantle the structure after objections had apparently been lodged by neighbors.

Jack, rather disgusted with the whole business decided to take the matter no further but to re-erect the tower at his week-ender well out in the country.

WIA NEWS

It was learnt with regret, that during July, president Wal Nye, VK2XU, and past-president Jim Corbin, VK2YC, resigned from the Council of the NSW Division. Both found that private business interfered with the efficient carrying out of their Institute duties.

With them goes a wealth of experience and knowledge of amateur radio, and of the Institute in particular, but both assured council they would render assistance where possible. They have in the past really spent too much of their time working for the hobby and our welfare.

New president of the Division is John Moyle, VK2JU, who needs no introduction to members, or for that matter, to amateurs throughout the Commonwealth. He carries the best wishes of all concerned in the new position.

New members of Council are Fred Phillips, VK2ZQ, and Lyle Woolnough, VK2GW. Both are amateurs of many years standing, the former has been a behind-the-scenes worker for the Division especially as chairman of the Disposals committee. Lyle is well known especially on the 10 and 20-metre bands mainly on CW and always amassed a good score in the various contests.

A decision of the NSW Council has been reached to the effect that recorded technical information will be made available to country groups. An expression of opinion will be obtained from country zone officers as to likely centres, where recorded lectures could be presented.

Final arrangements are as yet not made but it would appear as if lectures presented at general meetings will be recorded on tape, transcribed to micro groove and with suitable diagrams be sent out to country centres. A considerable amount of work is entailed especially in the preparation of the diagrams. The whole scheme was outlined to the Council by the Technical Officer Joe Reed, VK2JR, who presented recently a recorded lecture to the general meeting and also to the Hunter branch.

The latter meeting, held at Maitland on August 10, was attended by 50 members from as far afield as Muswellbrook and the coalfields. Everyone in attendance spoke highly of the recorded lecture, presented personally by VK2JR. Meetings of the Hunter branch are normally held in Newcastle and the change of venue did much to keep amateurs further up the valley interested and informed.

The NSW Division's Woy Woy Field Day will be held this year on Sunday, November 18. It will provide an opportunity for the Newcastle and Sydney groups to mix and also an excellent day's entertainment. Full program details will be available later, and will contain some new and novel features.

OVERSEAS COMMENT

A novel departure from normal regulatory restrictions was the temporary vacation by US amateurs of that portion of their 3.5 Mc band between 3700-3900 Mc for a period of a month, US Army occupying the frequencies for the period.

Special operations were conducted in south-east US and due to their size and nature it was necessary to obtain additional frequencies outside normal military channels.

A great number of 10/20 watt portable and mobile stations were in the field. According to an American broadcast the scheme worked out very well. Not only was the portion of the amateur band utilised, but practically all frequencies between 4 and 7 Mc were in use.

The scheme was originally arranged after a conference between US Army Signal authorities, the FCC, and the ARRL and was arranged to allow equal loss to both CW and Telephony sections in the amateur bands.

The last ARRL board meeting decided on several innovations. They decided that headquarters should proceed immediately with the issuing of booklets, giving publicity and supplying suitable technical information for intending applicants for the new Novice and Technical class licences.

Incidentally, full details of technical requirements for the Novice class appeared in June QST. From the information published the examination will be an extremely simple one, and with only a five-word-per-minute Morse requirement, we should see an increase of tens of thousands of amateurs in the US within the next couple of years.

TVI was discussed at length and an all out effort will be made by ARRL technical staff to find cures. The FCC will be requested to allow NBFM operation on all phone bands, to permit teletype operation between 7250 and 7300 Kc, and to increase amateur privileges between 1800 and 2000 Kcs'

Amateurs in most of the US States now have motor registration plates bearing their call-signs. Amateur radio clubs in the various areas worked hard to ensure the passage of appropriate bills through the legislature. Amateurs over there put forward a very strong case supported by their extensive emergency and civil defence work.

One State police department in supporting the scheme pointed out that in times of emergency amateurs' cars would be readily contacted with their special number plates and could immediately be summoned.

DX AND PERSONAL

Early winter saw some interesting feats performed on the 160 metre band and reports are gradually coming to hand showing the extensive coverage throughout the world.

Contacts half way around the world were recorded, one between VE1EA and HZ1KE being over 7000 miles. Quite a number of East Coast American stations have been reported heard in New Zealand.

Stations using the following prefixes have been active—VE, W, EK, HC, G, GW, HZ and KV4. EK1AO using 300 watts to a doublet antenna made 17 American contacts in 24 hours—a good record.

The ZL's are certainly making good use of their 40 metre Telephony privileges, most noticeable between 1600 and 1700 hours when the band is choked with them.

Returning from the position of zone officer for the North Coast NSW, a position he has filled so ably, is Crieff Rettalick, VK2XO. Crieff's efforts in the way of "Urunga Conventions" are well known to amateurs from many States, and it is hoped these yearly zone conventions will continue. Noel Hanson, VK2AHH, of West Kempsey, takes over the position as zone officer.

Harry Hawkins, VK2YL, believes he heard two W stations operating on the 144 Mc band at 1400 hours on July 10. They were W6FTN and W6BAD. VK2YL has written away for confirmation and hopes for conclusive results this time.

The 144 Mc contest run by the NSW Division's UHF section was extremely well supported. 40 different stations were active on the one day and 65 stations during the contest period of three weeks.

A number of stations operated portable, adding to the interest and it is hoped the general influx to the band will be permanent.

The G's have been going places on the 144 Mc and first contacts to OZ and SM were made during June. G3WW contacting OZ2FR with RS8 signals both ways, while G5YV worked SM7BE with similar signal reports. Other contacts were also made between these countries. The openings were continuous and fadeless—like ground wave working for periods up to 25 minutes. Distances England to Denmark 500 miles, to Sweden 700 miles.

R. D. CONTEST

As we go to press, the Remembrance Day contest has just concluded, and was highly successful. Some good scores of over 600 have been received. A large number of amateurs took part in every division. Those registering six or more contacts can score one point for their divisions by sending in a log. Every one helps, particularly in the larger divisions where it is difficult to build up a high percentage of entrants.

STANDARD -FERGUSON- RANGE

POWER & VIBRATOR TRANSFORMERS

	A.C.	Vib.			Retail
PF 122	240	6,220	40	6.3V @ 2A	61/8
PF 125	240	6,250	60	6.3V @ 2A	71/11
PF 119	240	6,325	125	6.3V @ 4A	102/5
PF 182	240	12,200	40	12.6V CT @ 1A	61/5
PF 126	240	12,250	60	12.6V CT @ 1A	71/11
PF 146	200,30,40	12	325	150	12.6V CT @ 2.5A	120/9

FILTER CHOKES

	Induct	D.C. Res.	M.A.		Retail
CF 100	50	1900	10		33/8
CF 101	30	870	25		33/-
CF 102	15	300	60		25/8
CF 103	30	420	60		48/2
CF 104	30	580	75		51/2
CF 105	15	250	80		43/1
CF 106	12	200	100		43/8
CF 107	30	360	100		59/2
CF 108	12	135	150		61/7
CF 109	20	225	150		64/3
CF 110	12	100	200		74/8
CF 111	16	165	200		74/8
CF 112	10	70	250		74/8

SPECIAL CHOKES

CF 113	.5	70	250		
	20		50	Swinging choke	82/-
CF 114	1.1	23	375	Ballast choke	51/3
CF 115	.017	.6	2 amps	L.T. choke	22/6

OUTPUT TRANSFORMER TO VOICE COIL
Full Frequency Range (30-15,000)

Code No.	Pri. Imped.	Sec. Imped.	Watts	Retail
OP24	5000 SE	8.4, 2.1, with feed back	5	77/-
OP23	3250 SE	12.5, 8.4, 2.1	10	112/3
OP19A	5000 PP	12.5, 8, 2.3	15	163/5
OP51	4500 PP	15.5, 12.5, 8.6, 2.7, 2	20	153/3
OP63	10000 PP	15, 3.75	15	174/6
OP64	10000 PP	12.5, 3.125	15	174/6
OP65	10000 PP	8.4, 2.1	15	174/6

OUTPUT TRANSFORMER TO VOICE COIL
Special Full Frequency (20-30,000)

OP25/40	10000 PP	40, 10	15	183/4
OP25/16	10000 PP	16, 4	15	183/4
OP25/15	10000 PP	15, 3.75	15	183/4
OP25/12	10000 PP	12, 3	15	183/4
OP25/10	10000 PP	10, 2.5	15	183/4
OP25/8.4	10000 PP	8.4, 2.1	15	183/4
OP66	5000 PP	8.4, 3.7	15	219/6
OP67	5000 PP	15, 6.5	15	219/6

OUTPUT TRANSFORMER TO LINE—
Full Freq. Range

OP22	3250 SE	500, 125, 2.3	10	112/3
OP19b	5000 PP	500, 250, 125	15	163/5
OP21	8000 PP	500, 250, 125	15	133/6
OP62	10000 PP	500, 125	15	174/6

OUTPUT TRANSFORMER TO LINE—
Special Full Freq. Range

OP25/500	10000 PP	500, 125	15	183/4
OP25/250	10000 PP	250, 62.5	15	183/4

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	M.A.	Buffer Full Sec.		Retail
VT 100	32	200	40	.005	Sync.	50/9
VT 101	6	90	15	.008	"	39/11
VT 102	6	150	25	.005	"	46/6
VT 103	6	200	50	.005	"	49/-
VT 104	6	250	60	.005	"	50/2
VT 105	12	250	60	.005	"	51/11
VT 106	6	300	75	.008	"	82/10
VT 107	6	250	60	.005	Sync. Low Rad.	54/10
VT 108	12	90	15	.008	Sync.	41/5
VT 109	24	90	15	.008	"	43/9
VT 110	12	150	25	.005	"	49/-
VT 111	24	150	25	.005	"	53/8
VT 112	12	200	50	.005	"	51/4
VT 113	24	200	50	.005	"	51/4
VT 114	12	300	75	.008	"	89/3
VT 115	24	300	75	.008	"	90/3
VT 116	24	250	60	.005	"	57/2
VT 117	12	250	60	.005	Non Sync. Low Rad	55/5
VT 119	32	150	25	.005	Sync.	49/2
VT 121	6	180	30	.005	"	51/4
VT 122	6	400	50	.005	"	83/10
VT 123	12	320	125	.005	Sync.	107/10
VT 124	32	250	60	.005	"	56/-
VT 127	6	200	50	.005	Sync. Low Rad.	51/4
VT 128	12	250	60	.005	Sync. Low Rad.	60/8

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Retail
PF 185	240	150	30	6.3V @ 2A	50/2
PF 106	240	325	45	6.3V @ 2A, 5V @ 2A	53/11
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	50/2
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	60/8
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	66/6
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	72/2
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	69/5
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	77/9
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	87/3
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	97/6
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	109/2
PF 174	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	102/5
PF 175	200,30,40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	127/9
PF 173	200,30,40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	197/9
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	185/-
PF 171	200,30,40	385	250	6.3CT @ 4A, 6.3V @ 3A, 5V @ 3A	243/7
PF 201	240	225	50	6.3 @ 2A	51/1

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	Retail
MT111	500	12.5, 8, 2.3	10	69/1
MT100	600	4, 3	15	64/2
MT101	500	15	15	64/2
MT124	600, 500	4, 3, 2.7, 2.3, 2	25	107/10
MT125	600, 500	15, 12.5, 8.4, 6.5	25	105/2

MODULATION TRANSFORMERS

MT118	8000, 6000 PP	10000, 7000 5000	25	169/4
MT119	8000, 6600, 3800 PP	10000, 7500, 6500 5500, 4500, 3500	50	195/1
MT120	500 to 20000 in steps.	500 to 30000 steps.	50	356/10
MT121	500 to 20000 in steps.	500 to 30000 steps.	125	444/-

Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1	5000, 2500 SE	12.5, 8, 2.3	10	71/3
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	10	82/3
OP39	5000, 2500 SE	15	10	72/6
OP33	5000, 2500 SE	5, 2.7	10	72/6
OP41	5500 SE	3.7	10	81/1
OP53	30000, 20000 14000, 10000, 7000 5000, 2500 PP	2.3	10	70/1
OP2	5000 PP	12.5, 8, 2.3	15	109/11
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	120/5
OP3	6600 PP	12.5, 8, 2.3	15	109/11
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	120/5
OP4	10000 PP	12.5, 8, 2.3	15	109/11
OP57	10000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	120/5
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	109/11
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	121/11
OP59	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	152/9
OP60	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	32	195/-

OUTPUT TRANSFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1A	5000, 2500 SE	500	10	71/3
OP44	5000, 2500 SE	500, 250, 125	10	84/8
OP34	5000 PP	600, 300, 200, 150, 130, 100 75, 50	15	131/-
OP6	5000 PP	500, 250, 125	15	109/11
OP7	6600 PP	500, 250, 125	15	109/11
OP50	8000 PP	600, 300, 120, 60, 30	15	228/4
OP8	10000 PP	500, 250, 125	15	109/11
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	118/6
OP9	10000, 6600, 5000 PP	500, 250, 125	15	109/11
OP10	5000 PP	500, 250, 125	25	132/6
OP11	6600 PP	500, 250, 125	25	132/6
OP38	6600 P	600, 300, 250, 200, 170, 150 76, 50, 36, 27.12.5, 7.5,3.6, 2.7	25	228/4
OP12	10000 PP	500, 250, 125	25	132/6
OP13	10000, 6600, 5000 PP	500, 250, 125	25	132/6
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	187/4
OP14	5000 PP	500, 250, 125	32	161/-
OP48	6600 PP	140, 70	32	195/1
OP15	6600 PP	500, 250, 125	32	161/-
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	162/6
OP16	10000 PP	500, 250, 125	32	161/-
OP17	10000, 6600, 5000 PP	500, 250, 125	32	161/-
OP36	3800 PP	17.6	60	171/-
OP18	3800 PP	500, 250, 125	60	173/4
OP61	3800 PP	100, 75, 50, 25, 10, 5, 2	60	223/-
OP37	6400 PP	500, 250, 125	80	236/3
OP49	8800, 6000 PP	500	105	355/10
OP20	11600, 8400 PP	500, 250, 166, 125	150	451/-

ALL PRICES SUBJECT TO ALTERATION WITHOUT NOTICE

ENIGMA OF THE ELUSIVE VIRUS

(Continued from Page 13).

hether anything has been found
out the virus which causes human
s. It must be remembered that it
as not until 1935 that the virus
ystal became available for study
it certain progress has been made.

It must also be borne in mind that,
en if crystals of say, poliomyelitis
rus, were obtained, one simply
n't go running around injecting
ople with it to see what happens.
is a simple matter to try out plant
d certain animal viruses but not
all simple for the human variety.

But certain similarities have been
und which seem to show that tob-
co mosaic virus is similar in effects
the virus of animals.

Firstly, both types can be rendered
rmless. Just as the dried spinal
rds of dogs which have died of
rdrophobia can be used to obtain
harmless material, so the crystals
the tobacco virus can be rendered
rmless by treatment with ultra
olet rays, hydrogen peroxide or
rmalin.

PPEARANCE

The crystals after treatment ap-
ar to be no different in appear-
ce to the untreated crystal. They
ow the same atomic weight and
nen injected into animals they pro-
ce an anti-serum which can be
bsequently used to render innocu-
s, solutions of the virulent crystals.

This seems to point the way to the
aking of a vaccine or anti-serum
r the treatment of virus diseases
t this has not yet been accom-
ished.

An animal virus has been isolated
nich causes the disease of rabbits
lled "papillomatosis." This disease
uses warts to grow on rabbits'
rs. Again it has been found that
is crystal has an enormous atomic
eight. In fact, many plant disease
ruses have been crystallised and
are of this enormous molecular
ructure. All the crystals are viru-
nt and capable of infecting healthy
ants.

A remarkable phenomenon has
en noted in connection with the rod
e crystals of the virus. In solu-
ons the rods arrange themselves
2) exactly parallel to each other
nen they are brought close to-
ther by evaporation of the solution.
is has been attributed to the in-
ence of outside long range forces,
e nature of which have not been
termined.

RRANGEMENT

Normally the crystals arrange
emselves end to end, forming long
ands of great strength. It is not
own how the ends find each other
how they unite in such great
ength. It has been demonstrated
at the rods follow the field from
alternating current.

When the rods are treated with
e vibrations from high intensity
und they break into firstly half
ngths, then quarter lengths and fin-
y eight lengths. They lose infec-
e activity and can be caused to
unite again end to end but are not
bsequently as virulent as the orig-
al full length rods.

These unusual phenomena are
zzling at present and no explana-
tion has been forthcoming other than the influence of outside forces.

The way in which these crystallisable proteins multiply in the living cell is at present a complete mystery.

Ordinary bacteria multiply by division but there is no evidence that the viruses multiply in the same manner.

An interesting proposition has been put forward that the virus is a gene gone on the loose. A gene is not what appeared to Aladdin when he rubbed the lamp. It is that mysterious component of the human cell which governs our character and by which are passed from our ancestors all the characteristics of our makeup.

Both genes and some viruses seem to be large nucleoproteins and both have the ability to multiply only within the living cell. Both undergo changes within the cell and such changes are reproduced in subsequent generations.

Both genes and virus appear to be about the same size and both can suspend their functions for a long period of time only to become active when conditions are favorable.

It has been demonstrated that the virus of one strain of tobacco mosaic disease may without any apparent reason suddenly change to that of another strain. This is similar to the mutations which occur in plants and animals because of the mutations of unstable genes.

In the living cell the activity of one gene is dependent on the existence of its fellows. In other words a single gene is inactive.

Dr. Stanley thinks that a single molecule of a virus is also inactive and only becomes so when associated with its fellows.

RESEARCH CONTINUES

In the meantime research is proceeding rapidly but, unfortunately, not rapid enough to reduce the toll of the many virus diseases with which we are afflicted.

Our knowledge of viruses is much greater than a few years ago. The mere fact of the isolation of these weird crystals which are alive and yet not alive, which are organisms and yet not organisms, has paved the way to the day when crippled limbs, pock-marked faces and running noses will be no more. That day may not be far away, thanks to Dr. Stanley and his co-workers in other countries, not excluding Australia, where some remarkable research is now in progress.

OFF THE RECORD — NEWS & REVIEWS

The article by G. F. Dutton reprinted on page 45 of this issue is the most interesting thing I have seen for a long time on the subject of long-playing records. It is not only an excellent summary of the position, and a factual comparison between the three speeds of 78, 45, and 33 rpm, but because the author is a responsible and highly qualified engineer from E.M.I. it must be taken as an indication of this company's point of view.

By JOHN MOYLE

TO go back briefly to the beginning, it will be remembered that Columbia in USA were the first to break the ice with long-playing microgroove records at 33 rpm some two or more years ago. In answer to this effort, RCA issued their now-famous little record changer which played at 45 rpm and changed records with breaks of only three seconds. The records were 7in in diameter, played for 5 minutes 20 seconds, and had a 2in hole in the centre to accommodate the cylindrical pillar in which was housed the record-changing apparatus.

Both types were microgroove records, but obviously only Columbia were true long-playing types. They went up to 25 minutes without a break. Both used vinylite and had negligible surface noise.

Then followed great ructions and commercial warfare in which both firms spent huge sums of money attempting to swing the entire market their particular way. After several attempts to settle on one speed, negotiations broke down, and USA now accepts its three speeds, with practically every record company making all types.

In England there was a dilemma. EMI, of course, is the same company as RCA-Victor, protagonists of the 45 rpm. It also issues Columbia records, under which label 33 rpm first appeared in USA. It had an enormous world-wide business in 78 records on its hands, and a big decision to make about a new standard. About the only thing it was sure of was that sooner or later a new standard would be necessary.

In England, about 12 months ago the Decca company took the plunge. This isn't the same as the American Decca company, nor is it associated with EMI. Its 33 rpm records, already tried out on the American market, were hugely successful, and have been enthusiastically received here in Australia. They are by far the best examples of disc recording we have heard here.

To date, EMI have not declared themselves one way or the other, except to announce that before they adopt any speed other than 78 they will give the world six months' notice. Most of the world has been on their doorstep ever since waiting for the green light. But no further statements have been made.

This is the position broadly speaking at the present time, and because of it, this article by Mr. Dutton must be considered quite significant.

The reason I say this is because it is the first technical paper issued by an engineer from EMI from which any conclusion can be drawn about the best speed. It is issued at a time when any such statement would naturally be subject to close scrutiny. It is hardly likely that such an article would be issued to demonstrate the desirability of one speed if EMI actually intended to use another.

Technical readers will have little difficulty in following the points made in the article, but for those not so inclined the point of the article was to show that it is practicable to make long-playing records at 45 rpm, and that this speed is far superior to 33 rpm for single items of shorter duration.

BETTER QUALITY

In the long-playing field, it shows that for a 12in record, 45 rpm produces better quality than 33 up to a playing time of 18 minutes. After that the 33 is better, because unavoidable distortion due to the lessened radius goes up rapidly. The point is that although 45 records run out of space more quickly than 33, they can be recorded closer to the centre without the effective speed of the stylus point slowing down too much.

Stylus speed is the same for both types 18 minutes from the start. After that the 45 is slower, although it is indicated that about 23 minutes could be expected with acceptably low distortion.

In the small disc field, the 45 records are much better—so much

so that the 33 rpm can almost be ge ruled out in favor of retaining he present 78 rpm for such records.

Now the point I'm making here s that, for the first time, we have a big record company introducing he subject of long playing 45 rpm records.

To date the whole 45 rpm case has been tied to the little record changer with its time limit of 5 minutes 20 seconds per disc. We have, among others, no doubt, visualised the 45 rpm "super-player" as I referred to it in our last issue, but there has been no suggestion that anyone was considering it for manufacture. I don't think now we can do other than suspect that EMI has done a great deal of consideration along these lines, and may have already decided that when it does cast the die, 45 rpm will be its new standard.

From the consumer's point of view, I don't think it matters now whether we have one record speed or three. Earlier in the piece it would have been helpful to limit our choice to a long-playing speed plus the inevitable 78, which in any case will probably never die. But now we are sure to see in Australia both 45 records as well as 33 types, of which a quantity have already been sold and more are promised. It is just as easy in most cases to make a turntable for three speeds as for two, and both 45 and 33 records use the same pickup and stylus.

LONG-PLAYING 45'S

So that although Mr. Dutton's article merely contains a clearly-expressed summary of facts known since the early controversy, it does change the position materially with its forecast of long-playing 45's. It also tacitly admits what has been clear in my mind from the start, that long playing is an essential feature to be catered for by any new standard which may be adopted. It is true that the huge single-disc business must be accommodated. But long-playing records, if not as valuable in turnover, are popular enough to make an unanswerable claim.

Moreover, I am sure that the joy of long-playing will in itself build most materially on the present demand for music calling for more than one disc, both classical works and more popular stuff, such as musical comedy.

Assuming that we do have long-playing 45 rpm records, how will they compare in practice with the 33 rpm types?

This isn't altogether easy to answer without a knowledge of what their manufacturer might have up his sleeve. Assuming a continuance and even improvement on the 33 type Decca records—and I have no doubt that even their best efforts will be improved upon—I must admit that the last few minutes of the 45's are causing me a little uneasiness.

With the present 33 records, superb though many of them are, the last half-inch or so isn't always above suspicion when played on really wide range equipment. I have detected traces of the same types of distortion so noticeable with 78's, although not nearly as bad. Present 78 records, I think, are recorded well past the safety limit for distortion, which unfortunately increases appreciably when the recorded level is high, as almost invariably it is.

It stands to reason, therefore, that if the 45 records are to go far beyond the 18-minute limit—accepting Mr. Dutton's own figures—they may not be as clean as we would like on good equipment, although the average type of radiogram mightn't know the difference.

Against this possible defect—and its validity has yet to be proved—I should expect the 45's to be sufficiently cleaner than 33's to be noticed on wide-range gear. Variations in quality between one recording and another might well obliterate the advantage, but there will probably be occasions when it will be there.

THE STYLUS

When considering distortion, we cannot afford to neglect the effect of stylus wear. It is very difficult to obtain records which are absolutely clean over the full range down to the last groove. It can only be done, given a perfect record, with a perfect stylus. Unfortunately a sapphire stylus will still play records without undue wear well after its point is worn enough to make clean, full-range reproduction impossible. Thus it is inevitable that yet another variable will come into the search for perfection.

At present, only a diamond stylus looks good enough for perfect wide-range playings over a period. We should be careful not to blame the records for everything!

It is, of course, a tremendous advance to make records which can be played at all on good gramophones with full range, without serious surface noise, but it is precisely this new ability to record wide range which is to blame for revealing distortion which now is completely hidden under much more serious limitations with 78 records.

VARIABLE GROOVING

Much will depend, I think, on the success achieved with the use of variable grooving, which allows the grooves to be spaced much closer together on quiet music than on loud passages. This technique is already being used, but even so we might yet see some struggles to get a man-sized movement on one 45 rpm side before running to the distortion danger point.

Finally, we must admit that 45 is the only speed which seems likely to be successful as a single standard speed in the future. 78 records would always be needed to back up 33 rpm on short numbers. It is, however, extremely probable that this will be the case in any event.

I cannot help feeling that the answer to all this will not be long now in emerging. It probably will mean no victory or defeat in the speed battle. We seem certain to have them all.

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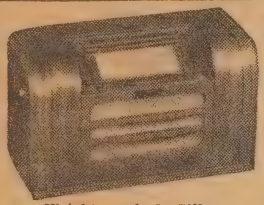

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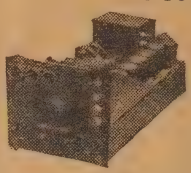

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EXPOSURE METERS—OLD AND NEW

(Continued from Page 79)

to be waved in the general direction of the subject in order to produce an infallible exposure calculation.

The other approach is the incident light method in which the meter is pointed at the source of light from the subject position. (Note that this should NEVER be done unless the meter is designed as an incident light meter). In this case the meter is so adjusted that it will indicate the correct exposure for the darkest object when illuminated by the prevailing light.

Reference to our previous example may help to make this clearer. In this case we would measure the light falling on the subject and the exposure calculated from it would be sufficient for the dark clothing of our first two subjects. This takes care of the "shadow" end of the scale quite automatically, and as we have already stated, the addition of the two subjects in white would not call for any change in exposure and, since we are measuring the source of light, none would be indicated.

Now let us consider the extreme case where the subjects in dark clothing move out of the picture leaving only the two in white. If we still measure the light source no change in exposure will be indicated, and it may be argued that this is incorrect since the subject now needs less exposure. It is true that the subject could be given less exposure, but on the other hand no harm will result if it is not and, in addition, there is little risk of under-exposure.

In many cases, particularly out of doors, the light at the camera is the same as that on the subject, so that it is not necessary to move from the taking position to obtain a reading. By artificial light, however, the distance from the light is critical and the reading must be taken at this distance. In some cases, as for example floodlight sports meetings, it is not always possible to approach the subject, which imposes a limitation on this type of reading.

Since both systems have advantages and limitations, some types have been recently designed which can be used in either way and this scheme would seem to have much to recommend it.

The whole point is that no system is completely free from limitations, although the incident light system seems to be gaining in popularity, particularly for color work where a high degree of accuracy is essential. However in this regard it is interesting to note the comments of a well-known color film maker, who claims that a higher percentage of successful pictures are obtained by people using light tables, than by those using photo-electric meters.

MAGNETIC RECORDING

(Continued from Page 59)

The remanent induction is, in fact, determined by two factors (1) the geometric centre of the loop and (2) by the instantaneous value of the audio component as the particle passes out of the audio field.

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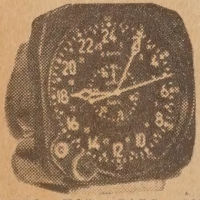

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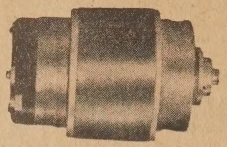

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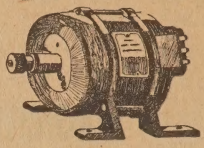

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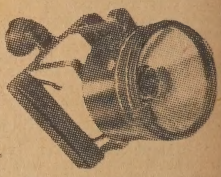

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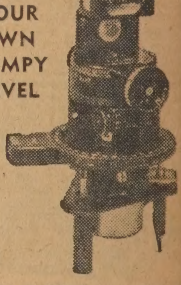

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A.: Many thanks for your subscription and for your very kind remarks in regard to Radio and Hobbies. We cannot think it would be worthwhile changing the speaker unless the present one is particularly old and battered, which is unlikely. There may be a slight difference in the sensitivity of the two speakers but it would probably be of small consequence. If you did wish to make an improvement in this regard, the obvious change would be to install a 12" speaker, assuming that there is room in the cabinet for a larger speaker and its more ambitious baffling requirements. In any case if you change to a permagnetic speaker it would be necessary to replace the present field coil in the filter circuit with a filter choke and series resistor to make up the same net DC resistance and thus preserve the same high-tension supply voltage.

C.McM. (Cobar, NSW) wants to know whether he could expect reception in his area using the Reinartz One receiver in the current "Learn While You Build It" series. He points out that his nearest radio station is 200 miles away.

A.: It is very difficult for us to give you a definite answer as we are not conversant with reception conditions in your area. One point is obvious, however, and that is that the receiver would have to be operating at its peak to do much good on such distant signals. A point in your favor would be that you could afford to erect a very large aerial, up to 100 feet in length and as high as possible. If used in connection with a good earth return such an aerial would go a long way to assist the receiver. We have no doubt that you would be able to hear the signal weakly from your local station, possibly from others as well, but you may or may not consider this to be satisfactory listening. With another stage added the position would be greatly improved although you would be still up against it to obtain good reception on the loudspeaker. If you could arrange to couple a pair of earphones to the "Reinartz Two" you would get quite good reception from the local station and the stronger nationals. Many readers have reported excellent results from small regenerative sets over large distances but we would rather be conservative in a case like yours, than lead you to spend money on a project which may not be 100 pc satisfactory.

V.A.C. (of Darkan, WA) points out that a paragraph in the Popular Science Quiz some months ago wrongly attributed the phases of the moon to the shadow cast on its face by the earth.

A.: We are aware of the error, V.A.C., and a couple of other readers have also mentioned it. How it actually got in remains something of a mystery, because the par was not written by any member of our present staff. We can only assume that it was slipped in at the last moment from standing material as a "fill" par, thereby escaping close scrutiny. Sorry, and we'll try not to do it again.

T.B.S. (Singapore) is worried about the blue glow which appears in some of his valves.

A.: It is quite normal for some valves, particularly power valves and rectifiers, to show a blue fluorescence on the inside of the glass envelope and this does not indicate that the valve is any way defective, in fact, it is usually a sign of high vacuum. On the other hand a blue glow in the region of the elements, particularly between the cathode and plate, is usually a sign of ionisation due to the presence of gas, and valves affected in this way seldom perform satisfactorily. There is little danger of the valves exploding, but a power valve so affected may draw excessive current, give distorted output and overload other components. When this later glow appears in a rectifier it may also indicate that there is an excessive current drain caused by a fault in the set. We regret that we have no record of the type you mention and can only suggest that you contact the advertiser concerned.

P.P.A. (Newcastle, NSW) wants to know if we have blueprints for the front panel and case of the latest Radio and Hobbies Checka-Meter.

A. Yes, P.P.A., both these drawings are available on the one blueprint, available through our postal service, price 2/6.

H.R.C. (Cobden, NZ) says he has received the first microgroove records and is impressed by their general quality.

A. Most folk are impressed the same way, H.R.C., and they can sound very impressive indeed on a good amplifier setup. However, we agree that information about recording characteristics, pickup response and such like is hard to get at the moment but we will certainly publish anything helpful that comes to hand.

B.C. (Nunhad, Q.) says he has built a one valve set and wants to add a valve to it.

A. The only one valve set in the May, 1949, issue was a circuit in the Reader Built It section, and we did not print any follow-up article on it. We may be able to help you, however, if you write again through the shilling query service and verify the type of valve you are using, the battery voltages and mention any other valve you may have on hand. In the meantime, if you are keen to learn by building, we would suggest that you follow the current series Learn While You Build It.

T.S. (Fremantle, WA) wants to know if he can use a Roblan brand of two-section tuning gang in the Three-Band-Three of the February, 1951, issue of Radio and Hobbies and also in the Basic Crystal Set of the March, 1951.

A. Yes, T.S., you could use one section of your particular gang tuning capacitor in either of those sets as the question of matching the tracking law with the dial station markings does not come into the picture. The maximum and minimum values of the capacitance of one section are close enough to that of the types used in the original sets as not to warrant any change in the coil data.

R.D.B. (Townsville) makes inquiries as to where he can obtain some parts for the Radio & Hobbies No. 4 Kit, and in particular a suitable dial.

A. Glad you found the article so helpful, R.D.B., and hope that the finished job will come up to expectations. We are not in a position to secure parts on behalf of our readers, and we can only suggest that you contact some of our advertisers who specialise in the supply of kits and parts.

E.W.C. (Heidelberg, Vic.) comments on our suggestions in an earlier issue about erecting wireless poles. He also makes the point that best results can be obtained by bringing down two equal wires, one from each end of the aerial and omitting the earth connection altogether.

A. Many thanks for your further comments, also your ideas about selectivity in crystal sets. The point of the matter is that the selectivity can be supplied only by the tuned circuit and the effect of different detectors would largely be in their reaction on the characteristics of the said circuit. Other readers may care to try out your ideas about the aerial connections. Unusual arrangements often work out well but are frequently related to special conditions and are less successful in other locations. However, it is worth a try.

J.E.W. (Dubbo, NSW) writes in appreciation of Radio & Hobbies and mentions in particular the "argument" and the photographic series.

A. Your remarks were much appreciated, J.E.W. Regarding your reactions to high fidelity, there is a likely explanation for the absence of the spine-chilling highs you have mentioned. Rather than enlarge on the matter here, we have put your letter aside and may attempt to answer some of the observations in the "argument" page at the first opportunity. If you have a good P-P 2A3 amplifier, it will probably do justice to anything you are likely to feed into it for the time being, particularly as the speaker you have has a limited top response.

J. McD. (Bowden, Sth. Aust.) renews his subscription and has a few nice comments to make regarding the magazine.

A. Thanks, J. McD., for your renewal subscription. It has been dealt with by the subs. department and you should have your official receipt by now. We are pleased to note your comment concerning the general contents of the magazine and particularly the success which you have had with the "Senior Portable." We are glad to add your remarks to the many others which consistently refer with enthusiasm to the articles The Serviceman Who Tells and the series on television.

N.G.H. (Yallourn, Vic.) sends along his subscription and includes in his letter a short interesting analysis of how 50 cycle disposal transformers can be used on a 50 cycle source.

A. Your subscription has been taken care of, N.G.H., with the commencement at the July, 1951, issue. We must admit that we have viewed the 500 cycle type of transformer in the same light as you have done so and, as a matter of fact, put them to various uses in one way and another in places where standardisation was not of prime importance. We may find space in the magazine to print your condensed treatment of the subject for the benefit of other readers.

L.P.S. (Herston, Q.) enquires about some alterations to the power supply of the 1946 Standard.

A. The use of the 83V will not call for any less filtering than if the original rectifier had been used, and we would recommend that you retain the two section filter. The need for the series resistors will depend on the impedance of the transformer, the main point being the need to limit the peak current flowing through the rectifier at the beginning of each cycle. If the impedance of the transformer is 100 ohms or more per plate there is no need to fit any resistors, but it may be safest to fit these if there is any doubt regarding the transformer.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C GPO, Sydney.

Wanted to Buy, Sell or Exchange

FOR SALE: Eddystone 640. Condition as new. £60 or best offer. **K. Echberg, 14 Glyde St., Mosman Park, W.A.**

FOR SALE: Amplifier P.P.807, 20w. Perfect order, £20. Also tuner, qty radio gear. **4818 Sun Office.**

FOR SALE: Ham gear, test metres and parts. Complete sale of all components. Write for list of parts and prices to **A. Thompson, 12 Rose St., W. Brunswick, Melbourne.**

FOR SALE: New TST Supertester (AC/VIB), service course and many parts, must sell. £60 or offer. **Smith, 42, 7th Row, St. Marys.**

FOR SALE: Complete set Radio and Hobbies for years 1946-1951 present issue. Any reasonable offer. **"Rockley," c/- 9 Moonga Rd., Toorak, Victoria.**

SELL: R. & H. "Pentagrid Five," new, with Rola 12-0 speaker. What offers? **E. Quartiero, PO, El Arish, N. Qld.**

SELL SCR522 receiver, all valves; MN26 Radio compass receiver, converted 240v including speaker, no dial; calibrated multimeter, meter including 3 shunts and meter rectifier. One 803 with ceramic socket; two 830B's with ceramic sockets. Radio Serviceman's Course, cost £20. Plate transformer, 240v/600-300-CT-300-600, at 200 mils; output transformer, 32 watt, 10,000/500, 250, 150 ohms; battery power supply, 12v input, 310v at 140 mils; number 19 transceiver. **Ring UF2591.**

SELL: Rola 12U Speaker, £11. Matching Ferguson Transformer OP25, £5. Redline Transformer, AE15 (unused), £8. Lightweight H.M.V. Pickup, £3. Columbia Pickup, £1. **H. C. Behan, 2a Rangers Av., Mosman, N.S.W. XM3712.**

SELL: Ham 100 watt plate-modulated transmitter. Complete, any reasonable offer. **XW8324.**

SELL: Eddystone 640 Receiver 1.8-30 m/c with speaker, also R107 Communication Receiver 1.2-18 m/c. 12v-250v. **Everest, 11 Milson Rd., Cremorne, Sydney.**

SELL: AR7, with all units, accessories, coils, in rack. Good order and appearance. Offers? **A. H. Hinkler, 249 Buckland Rd., Wavell Hts., Brisbane.**

SELL: 12-volt "Astor" car Radio complete, perfect condition, £25. **F. J. Lloyd, 27 Cedar St., Leeton.**

SELL: Nuclear "Sniffer," USA's smallest uranium-detector, pocket size, flashes and clicks when near radioactive minerals. £49½. **Sound & TV, 59 Goulburn St., Sydeny. MA1551.**

SELL: 3-valve battery set with circular dial and 6in. Rola speaker with 1C4, 1J6G, 1D4. £6. Batteries 15/- extra. Crystal set coil, detector, 1 gang condenser and dial 10/-. 1 pair 4000 ohm. earphones 14/-. 1 2000 ohm phone 4/-. Little General chassis 4/6. DA7 dial 7/-. Little General Cabinet 10/-. **A. Corker, 3 Dundas St., Wangaratta, Vic.**

SELL: Disc Recorder, portable 2-speed. Complete amplifier, MIC, &c. Xtal Cutter. **LB5184. BU3069 Bus. hours.**

SELL: R. & H. from Vol. 1, No. 1. Book of Popular Science, 12 vols Modern Radio Servicing, Radio Physics Course. By Ghiradi. **FU2151.**

SELL: Rola 12U. Brand new. £9. 156 R. & H. and A.R.W's. £3 the lot. **159 Scott St., Mortdale, NSW.**

WANTED: An old air-cored Pie-wound B/C Coil aerial or R.F. Pay to 15/-. **L. Gaul, 4 Palmer St., Camellia, NSW.**

WANTED: Palec or University Supertester, 3" or 5" C.R.O., Signal Tracer, V.T.V.M. Price and particulars to **J. O'Rourke, 202 Lava St., Warrnambool, Vic.**

WANTED: V.H.F. SCR522 Transmitter-Receiver, complete. State price. **C. M. King, Albert St., Corowa, NSW.**

EXCHANGE: B.R.S. R12 Junior Recorder, in good condition, for a knitting machine. Willing to make cash adjustment if necessary. **K. C. Hampson, 1 Scarborough St., Kogarah.**

EXCHANGE: S. & S. 45 watt, Hi. Fi. amp., capable of 80 watts, P.P. 807's. for oscilloscope and sig. generator. Offers? **A. G. Smith, 85 Japan St., Warrnambool, Victoria.**

EXCHANGE: Bendix BC211 Frequency Meter for BC348, 312 or similar receiver. Cash adjustment. Or for outright sale. **A. Jacka, Box 51, Bairnsdale, Vic.**

ANSWERS TO CORRESPONDENTS

J.R.N. (Cessnock, NSW) forwards a subscription to Radio & Hobbies and makes some comments on the articles he likes and dislikes. He also enquires whether we have available any circuits of signal tracers and designs for model train motors.

A. Your subscription has been forwarded to the appropriate department, J.R.N., who will send you an official receipt direct. Many thanks for your comments on the various articles, which are always welcome as they help us to give the readers what they want. Full details of a signal tracer were published in Radio & Hobbies for July and August, 1943, and a circuit is available through our postal service. We regret, however, that we have no details of the type of model motor you require, but suggest that some of the bookstalls, such as Angus & Robertson, may have some books on the subject and that you may care to contact them stating your requirements.

B.C.H. (Armidale, NSW) writes in appreciation of our Babygram design, which he chose as his attempt at radio building, and which he says is giving excellent results on both radio and records.

A. Many thanks for your letter and kind remarks, B.C.H., and we are glad to learn of your success at your first attempt. It is also interesting to know that you are getting such good results in your district, as the set was originally designed for use in metropolitan areas. The use of a larger speaker, such as your 8", will always give improved results and is well worth while if the extra size can be tolerated.